U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF SOILS—MILTON WHITNEY, Chief.

IN COOPERATION WITH THE UNIVERSITY OF NEBRASKA, G. E. CONDRA, DIRECTOR, NEBRASKA SOIL SURVEY.

SOIL SURVEY OF MORRILL COUNTY NEBRASKA.

BY

F. A. HAYES, IN CHARGE, AND H. W. HAWKER, OF THE U. S. DEPARTMENT OF AGRICULTURE, AND M. D. DAVIS AND V. H. SEABURY, OF THE UNIVERSITY OF NEBRASKA.

THOMAS D. RICE, INSPECTOR, NORTHERN DIVISION.

[Advance Sheets—Field Operations of the Bureau of Soils, 1917.]

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF SOILS,
Washington, D. C., April 29, 1919.

SIR: I have the honor to transmit herewith the manuscript report and map covering the survey of Morrill County, Nebr., and to recommend that they be published as advance sheets of Field Operations of the Bureau of Soils, 1917, as authorized by law. This work was done in cooperation with the University of Nebraska.

Respectfully,

MILTON WHITNEY,
Chief of Bureau.

Hon. D. F. HOUSTON,
Secretary of Agriculture.

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SOIL SURVEY OF MORRILL COUNTY, NEBRASKA.

By F. A. HAYES, In Charge, and H. W. HAWKER, of the U. S. Department of Agriculture, and M. D. DAVIS and V. H. SEABURY, of the University of Nebraska.—Area inspected by THOMAS D. RICE.

DESCRIPTION OF THE AREA.

Morrill County, Nebraska, lies in the extreme western part of the State, in the North Platte Basin. It is one of the larger counties of Nebraska, having an area of 1,417 square miles, or 906,880 acres.

The county lies in the Great Plains, in the division known as the High Plains. Through stream erosion a broad belt running from west to east across the central part of the county has been reduced several hundred feet below the original elevation, and only a small part of the county now lies at the true High Plains level. The eroded belt consists of a single broad belt in the eastern half of the county, but in the western part it is divided into two belts separated by a narrow upland remnant lying near the original High Plains level, known locally as Wild Cat Range. One of the lowland belts is followed by the North Platte River and the other by Pumpkin Creek. They include the existing flood plains of North Platte River and Pumpkin Creek, the terraces lying more or less continuously along both sides of these streams and a rolling lowland belt somewhat higher than the terraces extending from the outer edge of the latter to the base of the escarpments marking the rise to the High Plains. These escarpments lie along the extreme outer boundaries of the forked lowland belt, as well as along both sides of the Wild Cat Range.

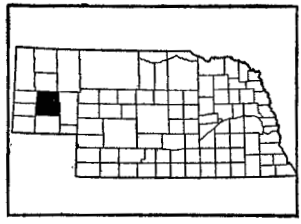


FIG. 1.—Sketch map showing location of Morrill County area, Nebraska.

That part of the lowland belt lying between the terraces and the escarpments is modified in many places by the presence of remnants of varying sizes and in varying stages of decay of a series of alluvial-fan deposits. The terraces retain their original structural topography to a great extent, especially the last terrace, bordering

the present flood plain. This is generally referred to as the low terrace. Lying just above it is the highest terrace remnant to retain its original structural topography. This is known in the State Survey of Nebraska as the Bayard Bench. It lies 50 to 75 feet above the adjoining low bench, and occurs principally on the north side of the North Platte River. The boundary line between this bench and the belt of undulating lowland lying between the former and the escarpment bounding the lowland is fairly well defined on the soil map, running along the southern boundary of the Bridgeport loamy very fine sand and very fine sandy loam types.

The alluvial-fan remnants lying along the outer edge of the central lowland belt range from mere patches of gravel of a few square feet in area to plateaulike remnants of several hundred acres extent. The larger areas are intact and preserve their constructional surface. This has invariably a well-defined slope toward the lowland axis. The larger ones lie as a rule directly out in the lowland from where tributary valleys open into it from the High Plains upland. The constructional surface of these remnants is neither uniform nor accordant in elevation, being higher near the mouths of large tributary valleys and lower near those of small valleys. Apparently none occur in either branch of the lowland between the main stream and the foot of the Wild Cat Range escarpment, due presumably to the fact that that range is too narrow to permit the development of tributary streams of sufficient size to build fans when they debouched on the lowland.

The topographic features of the county, therefore, consist of bottom lands or flood plains (terraces); a lowland belt modified by remnants of old alluvial fans, the larger ones lying well above the existing lowland belt, and by areas of modern alluvial fans; rolling lowlands; and areas of High Plains surface.

The North Platte River crosses Morrill County in a general easterly direction. The greater part of the area of the county lies north of the river. The flood plains along the river and Pumpkin Creek vary in width from a few rods to about 2 miles. Their surface is generally flat, modified in places by slight depressions.

The low stream terrace previously mentioned borders the flood plains of the North Platte River and Pumpkin Creek and extends for a considerable distance up their larger tributaries. The low bench along Pumpkin Creek is quite extensive, ranging from about one-half mile to 3 miles in width. Along the North Platte it is not continuous, being largely displaced by the first bottom.

The principal high-terrace development is on the north side of the North Platte in the western part of the county, where it borders the low terrace on the north. The part of this high bench lying

within Morrill County is triangular in shape, being 4 miles wide at the west county line and only 1 mile wide at its extremity 8 miles east. A smaller remnant of the high terrace occurs on the south side of the river and another about 4 miles east of Northport, on the north side. The high-bench remnants are flat to very gently undulating. They lie 50 to 75 feet above the low terrace, and the slope between the two is comparatively steep.

Along the North Platte River and Pumpkin Creek the valleys generally have a comparatively long, gradual slope to the escarpments bordering the rough upland. In some places, however, especially in the eastern part of the county and along the northern side of Pumpkin Creek in the western part, the escarpments either border or lie but short distances from the stream channels.

The valley sides have been modified by recent-colluvial fans, and are smooth to rolling. The valley slopes along the North Platte River consist of long, gradual grades modified by occasional broad, shallow valleys. In places, however, the slopes are dotted with low gravel-covered hills and ridges, representing remnants of the older alluvial fans. Those parts of the old colluvial fans which have resisted erosion have a flat to gently undulating topography. They are very inextensive, and occur only on the high divides south of Pumpkin Creek.

The upland includes that part of the county lying back of the escarpments, and consists of areas of Rough broken land, uneroded remnants of the High Plains, and large developments of Dunesand. It comprises a little over half the area of the entire county. Approximately nine-tenths of the upland lies considerably below the level of the High Plains.

The rough, broken areas include considerably over 10 per cent of the county. They represent badly dissected remnants of the High Plains, and generally occur in narrow strips bordering the edge of the lowlands. Remnants of the High Plains occur in the northwestern and southern parts of the county, occupying about 3 per cent of its total area. Their surface is level to gently undulating. The Dunesand areas occur chiefly in the northern and northeastern parts of the county, and occupy about one-fourth of its total area. Small bodies occur on the long colluvial slopes south of the North Platte River. The topography is characterized by sandy hills and ridges alternating with narrow valleys and depressions in which lakes and marshes often occur.

The lowest elevation in the county is at the point where the North Platte River crosses the eastern boundary, being approximately 3,480 feet above sea level. The highest elevation recorded by the

U. S. Geological Survey is 4,540 feet, on the western county line, in sec. 7, T. 19 N., R. 52 W. The most abrupt relief occurs in the western part of the county between the North Platte River and Chimney Rock, a prominent landmark. Its summit is 4,242 feet above sea level, and the elevation of the river about 2 miles distant is 3,740 feet. An elevation of 4,460 feet is attained in Wild Cat Range, about 2 miles west of Redington Gap. The elevations of other prominent landmarks are: Round House Rock, 4,255 feet; Twin Mounds, 4,349 and 4,309 feet; and Courthouse Rock, 4,100 feet.

The North Platte River in its course of about 42 miles in this county has a fall of 260 feet, averaging 6 feet to the mile. It flows in a shallow channel, varying in width from one-half to three-fourths of a mile. The flow is generally quite sluggish except during times of abnormal precipitation, when floods occasionally occur. They seldom cause damage, however, as the land adjoining the stream channel is used almost exclusively for pasture and hay production.

The North Platte is very slowly deepening its channel. Some parts of the flood plain are being built up, while others are being worn away. In its course across the county the river receives but little drainage. Most of the tributaries lose their water by absorption in the loose, porous subsoils of the second bottoms or are exhausted by numerous irrigation canals. Pumpkin and Cedar Creeks, in the southern part of the county, are the only constant natural tributaries.

With the exception of the North Platte River and Pumpkin Creek, all the drainageways of Morrill County have a comparatively steep gradient and are swift flowing. By far the greater part of the county is well drained. Waterways reach all sections except the sandier parts, where the run-off usually finds its way to the North Platte River through subterranean channels. In a few places this underground drainage is insufficient, and there are small areas of poorly drained land. In addition, much of the first bottom or flood plain along the North Platte River and Pumpkin Creek is poorly drained, owing to the flat topography and to the seepage of irrigation and drainage waters from the higher levels.

Morrill County was formed from Cheyenne County in 1909. Settlement began as early as 1885 on the lowlands along the North Platte River and Pumpkin Creek. The early settlers were of mixed descent, a large percentage being American born. The population of Morrill County is reported in the 1910 census as 4,584. Practically 77 per cent of the inhabitants are white persons of native parentage.

The population of Morrill County averages 3.2 persons to the square mile. Settlement is densest in the immediate vicinity of Bridgeport and Bayard, in the North Platte Valley, and on the high terrace or river bench north of Bayard. The region surrounding

Broadwater also is comparatively thickly populated. The sandhill region and the areas of Rough broken land are very sparsely settled. Bridgeport, the county seat and principal town, has a population of about 2,000. Bayard, which had 261 inhabitants in 1910, now has a large sugar factory employing about 500 men during the operating season, and its estimated population is 1,500. Broadwater, Angora, Northport, and Redington are small towns, named in the order of their importance.

The transportation facilities of Morrill County are fairly good. A line of the Union Pacific Railroad follows the North Platte River across the county, passing through Broadwater and Northport. A branch of the Chicago, Burlington & Quincy Railroad between Denver and Alliance crosses the central part of the county from north to south. The towns of Bridgeport and Angora are on this line. A second branch line extending along the north side of the North Platte River into Wyoming passes through Bayard. From the beet-sugar factory at Bayard a short line extends northwestward into Scotts Bluff County.

Wagon roads are maintained along the section lines where possible, but in many places in the rougher sections of the county and in the sandhill region they conform to the topography. All the roads are of dirt construction, and the more important highways are kept in good condition. The county is well supplied with rural mail-delivery routes and rural telephone lines are fairly well distributed.

Marketing facilities in the northern part of the county are poor, owing to the distance from market and to the bad roads through the sandhills. Farmers in the eastern, central, and western parts market their products at Broadwater, Bridgeport, and Bayard, respectively. Those in the southern part market at Dalton, in Cheyenne County. Bridgeport and Bayard furnish a local market for dairy products. A creamery is operated at Bridgeport, creating a good demand for cream. There is an elevator at Broadwater. Beets are marketed chiefly at Bayard. Cattle and horses are shipped to outside markets, mainly Omaha and Chicago.

CLIMATE.

The climate of Morrill County is typical of the Great Plains, being characterized by cold winters and short summers, with great extremes in temperature. The rainfall is low and variable. It generally occurs in the form of local showers, and occasionally is torrential. The following table, compiled from records of the Weather Bureau station at Bridgeport, gives the normal monthly, seasonal, and annual temperature and precipitation:

Normal monthly, seasonal, and annual temperature and precipitation at Bridgeport.

Month.	Temperature.			Precipitation.		
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year (1910).	Total amount for the wettest year (1905).
	°F.	°F.	°F.	Inches.	Inches.	Inches.
December	25.5	73	−35	0.59	0.35	0.00
January	24.7	68	−33	.43	.40	1.30
February	24.9	78	−34	.56	T.	1.10
Winter	25.1	78	−35	1.58	.75	2.40
March	36.3	87	−20	.88	.80	.81
April	47.5	93	5	2.01	2.10	4.74
May	55.9	95	15	3.58	.85	5.59
Spring	46.6	95	−20	6.47	3.75	11.14
June	65.7	105	32	2.46	3.29	2.72
July	72.0	111	34	2.30	1.10	3.87
August	71.4	109	30	1.68	.20	1.65
Summer	69.7	111	30	6.44	4.59	8.24
September	61.8	103	14	1.12	1.16	1.24
October	48.8	97	7	.91	.02	.43
November	37.2	80	−19	.33	T.	.22
Fall	49.3	103	−19	2.36	1.18	1.89
Year	47.6	111	−35	16.85	10.27	23.67

The mean annual rainfall is about 17 inches, but the precipitation varies widely from year to year. The wettest year on record is 1905, with 23.67 inches of precipitation, and the driest year 1910, with 10.27 inches. About 75 per cent of the annual rainfall occurs from April to September, inclusive. About 50 per cent occurs in May, June, and July, with the maximum in May. From October to March, inclusive, the precipitation commonly averages less than 1 inch per month. The average annual snowfall is less than 2 feet. During the summer months hail sometimes does serious damage to crops over local areas.

The mean annual temperature is 47.6° F.; January is the coldest month, with a mean temperature of 24.7° F., and July is the warmest, with a mean temperature of 72° F. The lowest temperature recorded is −35°, in December, and the highest 111°, in July.

The average date of the latest killing frost in the spring is May 15, and that of the first in the fall, September 18. This gives an average growing season of 125 days. Frosts, however, frequently occur as early as September 1 and as late as June 1, making it nec-

essary to grow early-maturing crops. The latest recorded killing frost in the spring occurred June 6 and the earliest in the fall on August 25. The summer grazing season begins about the middle of May and usually lasts until November 1. Most of the grasses cure into hay under natural conditions and furnish considerable sustenance for stock throughout the winter.

The prevailing winds in the winter are from the northwest, and during the summer months from the south and southwest. High winds are common in both winter and summer, but tornadoes are unknown.

The climate of this region is the chief controlling factor in agricultural development. While the rainfall is not always sufficient for as high yields of grain as are obtained in the eastern part of the State, the farmers have adopted methods whereby fairly good returns of hardy and drought-resistant crops can be relied upon except in the driest years. The rainfall is usually sufficient to insure a crop of small grain and hay in favorably situated areas. The growing season, however, is short, and corn and oats sometimes fail to mature.

AGRICULTURE.

Prior to 1885 agriculture in this region was confined to grazing cattle on the open range, where a great variety of nutritious grasses afforded good summer and fair winter pasturage. During 1885 and 1886 the land was rapidly taken up by homesteaders, who first settled on the alluvial lands along the North Platte River and Pumpkin Creek. With the passing of the herd law in 1887 most of the cattlemen were forced out of the county. A few favorable years occurred after this, stimulating immigration, and by 1890 there was a farmer on nearly every quarter section of the county, except in the sandhill region.

Following 1890 there occurred some of the worst droughts the region has ever experienced, culminating in the extremely dry years of 1893 and 1894. Total failures of all crops resulted, and the new settlers were so impoverished that approximately three-fourths of them left the country. These droughts would not have checked development so seriously if the new settlers had been better prepared. They were not supplied with sufficient capital to maintain themselves during the first years of failure, the seed used was not adapted to the climate, and the means of conserving soil moisture by proper cultivation was not understood. Much of the vacated land fell into the hands of a few men who used their holdings for grazing under a system of combined stock ranching and grain farming. With the gradual return of settlers the large tracts were broken up.

By far the greater part of the county is still used as pasture and hay land, especially in the sandier regions and in the rough unirrigable areas. At the present time most of the irrigated land along the North Platte River and the smooth, well-drained land along Pumpkin Creek is held in comparatively large farms devoted to grain production and stock raising. Many ranches over the entire county have a few acres in cultivation for producing grain and forage for stock.

Native hay still exceeds all cultivated crops in acreage. In 1909, 54,837 acres were cut over for wild hay. The Nebraska State Board of Agriculture reports only 18,625 acres of wild hay cut in 1916, much of the area in native grasses having been plowed up. The wild hay consists of stipa or needle grass, sand grass, bunch grass, grama grass, buffalo grass, a sedge called blackroot, western wheat grass, marsh grasses, and salt grass. The first-named three grow on the sandier soils, especially in the sandhill region and on the slopes along the North Platte River. The other species grow on the heavier soils in the northwestern, eastern, and southern parts of the county. Marsh and salt grasses are cut on the alluvial soils of the North Platte Valley and in the poorly drained meadows of the sand hills. The yield of hay varies greatly from year to year. On the flood-plain areas along the North Platte River the yield ranges from 1 to 2 tons per acre. The upland hay yields from one-fourth to three-fourths ton per acre, depending upon the rainfall. Many of the meadows in the sand hills yield 1 to 1½ tons per acre. The greater part of the hay is fed during the winter months to work stock and cattle. The average yield of wild hay in 1916 is reported as 1.1 tons per acre.

Of the cultivated crops wheat ranks first in acreage and is the chief cash crop of the county. According to the report of the Nebraska State Board of Agriculture, wheat occupied 11,965 acres in 1916, a gain of 8,698 acres over the acreage in 1909. This great increase is due to the prevailing good prices and fair yields. Both winter and spring wheats are grown, the former occupying the greater acreage. Turkey is the principal variety of winter wheat. The chief varieties of spring wheat are durums. Most of the wheat is grown on the heavier soils. The yields vary widely, depending upon the rainfall, but 18 bushels per acre is a fair average. Winter wheat generally exceeds spring wheat in yield. Part of the crop is used locally, but most of it is shipped to eastern markets. The quality of the grain is generally very good.

Corn ranks second in importance among the grain crops. The census reports 11,504 acres in corn in 1909. The acreage is not increasing, as the Nebraska State Board of Agriculture reports 11,486 acres for 1916. Owing to the high altitude and the shortness of

the growing season only the earliest maturing varieties are planted, principally Blue and White Squaw corn, Small Yellow Dent, and Small Calico Dent. These produce smaller stalks and ears than the varieties grown in the eastern part of the State. The yields vary widely through a period of years, ranging from complete failures to 25 or 30 bushels per acre. The grain is used for feeding work stock and cattle. A few farmers raise more corn than they require and sell the surplus in the community, but the demand is greater than the supply, and there is a large annual importation from the corn belt.

Alfalfa ranks next to corn in acreage. The 1910 census reports 3,409 acres in this crop. The acreage has greatly increased during the last 6 years, as the Nebraska State Board of Agriculture reports 8,167 acres for 1916. Alfalfa is of local importance as a hay and forage crop. It is grown chiefly on the irrigated land of the high and low terraces, but to some extent is dry farmed. Under irrigation the crop generally gives three cuttings and yields 2 to 4 tons per season. On unirrigated land the yield is about 2 tons per acre under favorable conditions, and the crop is usually cut but twice.

Oats follow alfalfa in acreage. The area in oats increased from 4,086 acres in 1909 to 6,927 acres in 1916. This crop is grown on practically all the farms operated by owners, and ranks as one of the most important in the county. It gives better results on the heavier soils. Swedish Select and Kherson are the principal varieties. Yields are very uncertain, but in the best years 40 to 50 bushels per acre are obtained. In the drier years the grain sometimes fails to mature and the crop is then cut for forage. Oats generally are in good demand for feeding work stock.

Rye ranks next to oats in acreage. The 1910 census reports 443 acres in this crop, as compared with 1,199 acres in 1916. Rye is grown chiefly on the heavier soils, and generally for the grain, but it is also grown to some extent for hay and pasture. The yield is quite variable, ranging from 10 to 30 bushels per acre. The greater part of the crop is shipped out of the county, but some is fed locally to stock.

Sugar beets rank next to rye in acreage. The 1910 census reports only 2 acres in this crop, but by 1916 it was grown on 1,186 acres and the acreage has been greatly increased during the present year (1917), owing to the erection of a sugar factory at Bayard. The crop is grown entirely on irrigated land. The heaviest yields are obtained on the second bottoms or low terraces along the North Platte River, but a slightly higher sugar content is produced on the soils of the Bayard terrace, probably owing to better drainage conditions and to a smaller amount of alkali in the soil. The yields range from 8 to 15

tons per acre, with an average of 12 tons. The beet tops are in local demand for stock feed.

Potatoes were grown on 1,535 acres in 1909, but the acreage has decreased since then, as most of the farmers are growing more wheat. Enough potatoes for home consumption are grown on practically every farm, and some of the farmers have a surplus for sale. The principal varieties are the Early Ohio, Bliss Triumph, and White Eureka. Yields range from 50 to 250 bushels per acre, the highest yields being obtained on the irrigated land under very favorable conditions. The average yield per acre over the entire county is about 100 bushels.

Barley is grown on a few farms, and occupies a total of probably not more than 500 acres. It is grown as feed for stock. Flax is occasionally grown as a first-year planting on sod land. Beans are produced as a special crop on both irrigated and dry-farmed land. Emmer, millet, and Hungarian sorghum are grown to a small extent, in an experimental way. Millet gives fair promises of becoming a good hay crop.

Garden vegetables can not be successfully grown except under irrigation. Fruit has not been grown in sufficient quantities to supply even the local demand. The severe climate and the late spring frosts generally injure the trees, and fruits in general are not suited to local conditions. Plums and apples are the most dependable of the tree fruits, and gooseberries and currants of the small fruits. Wild plums, wild grapes, and buffalo berries are the principal native fruits.

As is the case throughout most of northwestern Nebraska, the raising of beef cattle and horses is the most important industry of Morrill County. The cattle are nearly all grass-fed stock, grown for market and for sale as feeders. They are usually shipped in the fall when 2 or 3 years old, though many are pastured throughout the winter, hay being fed during severe weather. The animals are principally grade Herefords and Shorthorns. There are a few herds of purebred Hereford. Most of the cattle are shipped to Omaha and Chicago. The census of 1910 reports 28,999 cattle on farms and ranges in the county, and 12,045 cattle and calves sold or slaughtered in 1909.

Horses are raised on nearly every farm, many of the larger ranches carrying from 100 to 200 head. Most of the stock has been improved from the western broncho, and is of medium draft type, ranging in weight from 1,100 to 1,300 pounds. The heaviest draft animals are used in the sugar-beet sections for hauling the crops to railroads and markets. In 1909 there were 9,803 horses on farms and ranges in Morrill County.

Hogs and sheep are raised on a small scale on many farms. These animals are generally fattened on corn, but alfalfa is added to the ration on irrigated farms. The 1910 census reports 3,170 hogs and 3,112 sheep in the county. Nearly every farm and ranch has a small flock of poultry, but few produce a surplus of poultry products.

In the vicinity of Bridgeport some attention is given to dairying. The herds on the ordinary farms contain from 4 to 10 head. Most of the milk is separated at home and the cream sold to the creamery at Bridgeport. Many farmers and ranchers throughout the county have a small surplus of dairy products, which is generally sold in Bridgeport or Alliance. Most of the milk cows are grade Herefords and Shorthorns.

In general, the heavier and deeper soils are recognized as most drought resistant and best adapted to the production of wheat, oats, and rye. They include the very fine sandy loams, silt loams, and loams of the high upland in the northwestern, eastern, and southern parts of the county. The areas of sand dunes, the broken land, and large areas where the underlying rock lies close to the surface are best adapted to grazing. The heavy flood-plain soils of the North Platte River and the poorly drained meadows of the sand hills are used almost exclusively for the production of wild hay. In the irrigated areas the finer textured, well-drained soils of the high terrace are preferred for beets, while the more sandy, porous types are recognized as best adapted to potatoes. Alfalfa does especially well on the irrigated terrace soils.

The farmers on the unirrigated lands, in order to conserve moisture, maintain as loose a surface mulch as possible without pulverizing the soil. A somewhat cloddy or rough surface is necessary to prevent the soil from blowing badly. The ground for small grain is not generally fall plowed, and the old land is usually plowed every third or fourth year. In preparing new land for small grain, heavy teams or tractors are used and the soil is broken with moldboard plows to a depth of 3 or 4 inches. The sod is double disked, to fill up all crevices, and the grain is drilled in. When the larger types of tractor are used heavy rollers followed by a grain drill are attached behind the gang plows, and the land is seeded as fast as it is broken. Where wheat follows small grain the seed is frequently drilled in without any previous preparation of the land. Wheat is often seeded between the corn rows before the latter crop is harvested.

Corn is generally listed on old corn or stubble ground, but is sometimes planted in the roughly broken sod without any previous or subsequent cultivation. Most of the corn is husked, but a large part is cut over for fodder, especially if the season has been dry and the grain has failed to mature.

Oats are generally drilled in, but many farmers sow the crop broadcast on old stubble or corn ground and disk it in. The crop is usually thrashed in the fall, but it is often cut for hay when the amount of grain does not warrant harvesting.

Rye is grown in the same manner as oats, except that it is seeded in the fall. This crop affords good grazing during the early spring, before the pasture grasses can be used.

In the irrigated areas along the North Platte River and in parts of Pumpkin Valley farming is more thorough, and scientific methods of watering the land and handling the crops are practiced. Sugar beets are the most important of the irrigated crops, followed by small grains, alfalfa, and potatoes. Sugar beets are planted between the first and the middle of May, on ground that has been previously plowed and well pulverized. The machine used in planting is a sort of lister which marks the row, excavates the furrow, and drops the seed at regular intervals. From 15 to 20 pounds of seed is used to the acre, in rows spaced 18 to 22 inches apart. The beets are planted at a depth of one-half inch to 1½ inches, depending upon the moisture condition of the soil. As soon as the small plants show three or four leaves they are bunched and thinned. A sort of hoe is used in bunching, one stroke removing all the beets except small bunches 8 to 10 inches apart. From these bunches all the plants are removed except the largest and hardiest one. The crop is cultivated or hoed sufficiently to keep down weeds and to maintain a surface mulch. The number of waterings depends entirely upon the soil and climatic conditions. Harvesting begins about October 1 and consists of lifting, pulling, topping, and piling the crop. Lifting the beets consists in loosening them so they can be easily pulled, and is done by a horse-drawn implement much resembling a subsoil plow. The beets are cut off 8 to 10 inches below the ground and left standing in the loosened soil. After the beets are lifted they are pulled by hand and thrown into rows, from which they are topped. Topping consists of removing the leaves, which contain but a small amount of sugar. A heavy knife is used and the tops of the beets are cut off in a single stroke at the point of the lowest leaf scar. After the beets are topped the roots are thrown into piles, from which they are loaded into wagons and hauled either directly to the sugar factory or to the railroad for shipment. If it is impossible to haul the beets at once, they are dumped into large piles and covered with a thin layer of soil. This operation is called siloing. The beets treated in this way bring a slightly higher price at the factory.

Since this county is in an early stage of development the farm equipment is not complete, but such implements as mowing machines, cultivators, hay stackers, and binders are in common use. Thrash-

ing machines travel from farm to farm after the grain has been harvested. Most of the thrashing is done from the shock. A good grade of horses is used for draft work, but tractors are coming into more general use, especially on the larger farms. Most of the farm buildings are small and roughly built. The fences are practically all of barbed wire, and are usually kept in good condition.

Crop rotations have not been adopted in Morrill County, as the land is new and in no immediate danger of becoming exhausted. In the irrigated sections where sugar beets are grown many farmers grow beets for 3 years followed by 3 years of small grain, potatoes, or alfalfa. No commercial fertilizers are used on account of the newness of the soil and the cheapness of the land. Manure is used on a few of the irrigated farms, with very beneficial results.

Farm labor is rather difficult to obtain. Ordinary day wages during the busy season range from $3 to $3.50. During the beet-harvesting period a man and team can earn $5 to $6 a day. When employed by the year laborers receive $30 to $50 a month, with board. Russians and Mexicans are employed in the production of beets, both for wages and on the share plan.

The size of the farms in Morrill County ranges from a few acres to several square miles. In 1910 there were 883 farms in the county, with an average size of 556.1 acres, and comprising 55.1 per cent of the total area. The prevailing size of farms ranges from 320 to 640 acres. There is an average throughout the county of 243 acres, or 43 per cent, of improved land on each farm, and improved farm land comprises about 23.6 per cent of the entire area of the county. In the strictly grazing and hay-producing sections the ranches vary from 640 to 35,000 acres, with an average of 1,280 acres.

By far the greater part of the farmers and ranchers own their land, but the proportion of farms operated by owners has decreased from 96.1 per cent in 1910 to about 75 per cent in 1916. The cash and share rental systems are equally favored. Cash rent ranges from $100 a square mile in the case of grazing land to $5 an acre on the irrigated areas. Share rent ranges from one-fifth to one-fourth of the crop, the use of pasture land generally being given to the renter without charge.

On account of the newness of the country it is difficult to determine land values accurately. The valuations given are based on estimates of reliable farmers. The best grades of upland in the southern, northwestern, and eastern parts of the county range in value from $15 to $60 an acre, depending chiefly on the location and improvements. The sandhill areas vary from $12 to $20 an acre, depending upon the proportion of hay land. Rough broken land sells for $6 to 10 an acre. The long colluvial slopes leading from the upland

toward the North Platte River on both sides of the stream range in value from $15 to $25 an acre, depending chiefly upon the improvements. The irrigated terrace land along the North Platte River and Pumpkin Creek ranges in value from $30 to $130 an acre, and the first-bottom or flood-plain land from $25 to $50 an acre, depending upon the location and drainage.[1]

SOILS.[2]

On the basis of origin the soils of Morrill County may be classed in four main divisions: (1) Residual soils, formed through the disintegration and decomposition of the underlying bedrock; (2) eolian or wind-blown soils; (3) colluvial and alluvial fan soils, which have accumulated either as colluvial wash or as alluvial-fan material upon the slopes of the high plains escarpment bordering the lowland; and (4) alluvial or stream-deposited soils. Most of the soils of the county have been considerably modified by wind-blown materials. The geologic formations in Morrill County belong to the Tertiary and Quaternary series. The oldest formations that outcrop are the Brule, Gering, Arikaree, and Ogallala formations, of Tertiary age.

The Brule division represents the upper member of what is known as the White River beds. It ranges from buff to almost white in color and consists mainly of silt and clay or a mixture of fine silt, clay, and sand. This formation is exposed chiefly along the escarpments at the edges of the rough, broken land, where it often forms cliffs or vertical walls. It also underlies the colluvial material on both sides of the North Platte River and is exposed in a few places where erosion has removed the soil covering. The exposures of the Brule formation are of relatively small extent and occur chiefly in localities where erosion is severe and the weathered soil material has been removed almost as fast as formed. Where undisturbed weathering has taken place, the Brule formation gives rise to a heavy silty to sandy soil.

The Gering and Arikaree formations constitute what is geologically known as the Loup Fork beds. The lower of these, the Gering, is a loosely bound sand deposit, which varies from coarse to fine and is often sufficiently cemented to be classed as soft sand-

[1] These prices appertain to 1917.

[2] Morrill County adjoins Scotts Bluff County on the west. In certain places the maps of these counties do not appear to agree along the boundaries. This is due in several places to changes in correlation resulting from a fuller understanding of the soils of the State. The Valentine very fine sand in Scotts Bluff County has been divided into the Bridgeport very fine sandy loam and the Valentine loamy very fine sand. The Tripp loamy fine sand, rolling phase, has been changed to Bridgeport loamy very fine sand in this report. The Rosebud stony fine sand of Scotts Bluff has been separated into two types in this area, the Rosebud very fine sandy loam, shallow phase, and Rough broken land. Only a small area of the Laurel very fine sandy loam as mapped in Scotts Bluff County extends into Morrill County, so on account of the small area it was combined with the Laurel fine sandy loam which it closely resembles.

stone. At its base there is usually more or less conglomerate of local origin. The Gering is exposed in the southern and eastern parts of the county and weathers into a sandy soil.

The Arikaree is the chief soil-forming formation in Morrill County. It contains considerable calcareous cement, which binds quite firmly the sand of which it is largely composed. It consists of gray sandstone with occasional harder layers of impure limestone. This formation is exposed quite generally over the county, especially on the north side of the North Platte River in the areas of rough, broken topography and throughout Wild Cat Range in the western part. It forms vertical cliffs along the escarpments bordering much of the colluvial-slope land of the Platte and Pumpkin Valleys. The resulting soil consists of silty to sandy loam.

Lying unconformably on the Arikaree sandstone is the Ogallala formation. This consists of sand, gravel, and silt containing a high percentage of lime, both in finely divided forms and in coarse fragments of calcareous rocks. The material is derived from a great variety of crystalline rocks, including quartz, feldspar, and granite. The Ogallala formation is exposed chiefly in the rough, broken land south of the North Platte River. The resulting soils are very similar to those derived from the Arikaree, and no soil separations are based on the origin of the material when only these two formations are concerned.

The high table land in the northwestern and southern parts of the county, where a capping of Arikaree or Ogallala sandstone has resisted the erosion that has taken place over the whole region, represents remnants of an ancient plain whose soils have been produced by the gradual weathering of the bedrock and are generally very shallow. The lack of moisture has caused the slowness of the weathering. Wind action is fairly constant and in places has removed the soil as fast as formed, so that frequent exposures of the parent geological formations occur.

The recent deposits of the Quaternary period consist of colluvial and alluvial fan material, alluvial terraces, flood plains, and large developments of dune sand.

First-bottom or flood-plain soils occur along both sides of the North Platte River, and in narrow strips along its larger tributaries. They are little elevated above the stream channels and are subject to occasional inundation during rainy periods. The danger from overflow has been greatly decreased since the building of the Pathfinder Dam, in Wyoming. The soils consist of silts, clays, and sands carried down from the regions to the west and to a smaller degree from the adjoining terraces, colluvial fans, and upland.

The alluvial terrace soils occur in irregular bodies adjacent to the flood plain, and at two different levels. The higher or Bayard ter-

race, which extends for several miles into Scotts Bluff County, was formed when the North Platte River flowed at a higher level than at present. It lies 60 to 150 feet above the present stream channel. The soils consist of intermixed Arikaree and Brule material, generally underlain at various depths by coarse sand and gravel which in turn lie directly on the Brule formation. Most of the soils of the high bench have been subjected to extensive weathering and have developed a light-colored subsoil seldom found in the more recently deposited terrace areas. The thickness of the alluvial material on the high bench varies from 50 to 100 feet.

The lower terraces lie 25 to 60 feet below the higher bench, and from 4 to 25 feet above the present stream channel. They occur as irregular bodies of varying width, adjacent to the flood plain. The soil is of fine texture, ranging from loamy fine sand to very fine sandy loam, and has been derived largely from the adjoining uplands. Some of the soils are very similar to those of the high terrace in drainage conditions and agricultural adaptations, and have been classed therewith.

On both sides of the North Platte River and along the south side of Pumpkin Creek are large areas of soils which have evidently been washed in since the cutting of the valleys of those streams. The soils are underlain at no great depths by the Brule formation and occsional outcrops of Brule material occur over the slopes.

The old original fans which at one time probably occupied the entire slopes between the escarpments and the main streams have been so eroded that only small remnants of their original surface remain, the greater part of their original area being occupied by minor valleys and recent alluvial fans. None of the soil material on the original fans or on the eroded portions shows any evidence of the action of the main streams, but has been made up from the wash of canyons, gullies, and slopes. It consists of colluvial, residual, and alluvial-fan material carried down from the country above the escarpments. The soils on the undisturbed remnants of the fans have been subject to longer weathering than those of the eroded portions, and have developed the light-colored subsoils characteristic of the residual types of the upland, but they are separated on account of their difference in origin. The soils of the eroded portions are of more recent derivation. They have been greatly modified by wind and water action, and show practically no difference either in color or texture throughout the 3-foot section. They are consequently separated from the original colluvial-fan soils in mapping.

The eolian or wind-blown soils are composed of materials blown from residual, colluvial, and alluvial areas. Strong winds probably

have always characterized the climate of the Great Plains, and have played an important part in assorting and distributing the soil materials. The action of the wind in disintegrating the Loup Fork sandstones and in transporting the soil materials is even at the present time very obvious. The eolian soils are distributed quite generally throughout the county, but they occur chiefly in the northern and central parts. Large areas on the colluvial and alluvial slopes have been so greatly modified by the wind that they have been classed as eolian. The eolian soils range from gray sands to grayish-brown loamy fine sand.

In the classification adopted by the Bureau of Soils, the soils are grouped into series on the basis of similarity in color, topography, and drainage. The soil series are divided into soil types on the basis of texture, or the proportion of mineral particles of different sizes. The type is the unit of mapping.

The residual soils of the county comprise the Rosebud, Dunlap, and Epping series. The eolian soils are classed in the Valentine series, in addition to Dunesand. The alluvial and colluvial fan soils include the Bridgeport series, and the alluvial or stream-deposited soils the Tripp, Cheyenne, Minatare, Laurel, and Gannett series. In addition, areas of certain miscellaneous materials are mapped as Riverwash and Rough broken land.

The surface soils of the Rosebud series are dark gray to brown. The subsoils are light colored and highly calcareous. A characteristic feature is the light-gray to almost white color of the deeper subsoil. The Rosebud soils are derived from the light-colored, calcareous, unconsolidated Tertiary deposits of the High Plains, and mainly from the Arikaree and Ogallala formations. Their topography varies from almost flat to steeply rolling. In places the surface is excessively eroded or dissected. The more hilly areas are frequently dotted with white exposure of the underlying formations.

The Dunlap series is distinguished by a brown surface soil, 6 to 12 inches deep, underlain by brown, compact silt loam. This passes gradually through a light-brown, heavy silt loam into a light-gray, calcareous silt. The Dulap series occupies the flat tops of the high tables representing remnants of the original high plains. Drainage channels are not established over the entire surface. The material has been derived through weathering from the fine-grained calcareous sandstones of Tertiary age under conditions of restricted drainage. The Dunlap series differs from the Rosebud series in its heavy, compact subsoil and more nearly level topography.

The surface soils of the Epping series are brown to gray, underlain by light-buff subsoils, usually somewhat heavier than the surface layer. The material is of residual origin, being derived from

the weathered Brule formation. The Epping series occupies undulating or dissected plains and sloping or comparatively level flats. Drainage is generally thorough, and in many places excessive.

The Valentine soils consist of dark-brown to grayish-brown sand, differing little throughout the 3-foot section. A characteristic feature is the absence of calcareous material. The Valentine soils are probably composed of partly weathered wind-blown material derived originally from the underlying Tertiary sandstone. The material has been so shifted by wind and water and subsequently weathered that it has lost most of its residual characteristics. The soils occupy level to sharply rolling upland plains. They differ from the members of the Rosebud series in the absence of a light-colored subsoil and in their lower lime content.

The soils of the Bridgeport series are grayish brown or brown. The material below 6 to 12 inches is sometimes slightly lighter in color, but more often there is practically no change in the 3-foot section. The Bridgeport soils consist of recent alluvial and colluvial material carried down from the adjoining uplands by intermittent streams and surface wash and deposited upon the valley slopes of the larger streams. Wind has also played an important part in their formation. The topography varies from gently undulating to rolling. Drainage is everywhere good. The Bridgeport soils differ from those of the Valentine series, which they often closely resemble, in the calcareous nature of their lower subsoils and in the small amount of gravel which is generally scattered over the surface.

The surface soils in the Tripp series are grayish brown to brown. The subsoils are light brown to gray and highly calcareous. In places the lower subsoil is almost white. The Tripp soils are alluvial, being developed on both high and low terraces along the North Platte River and its tributaries. They consist of sediments brought down from exposures of the White River and Loup Fork beds, which received a large subsequent admixture of wind-laid material in places. The surface drainage over much of the series is not well established, but the porous subsoil carries off all the surplus water. The topography is almost flat to very gently undulating.

The soils of the Cheyenne series have brown surface soils underlain by grayish-brown, coarse, gravelly subsoils, which are generally calcareous. The Cheyenne soils are derived from alluvial terrace material and from colluvial wash which has partly filled the higher valleys and draws. They differ from the Bridgeport in the large amount of gravel in the subsoil. They lie high above the overflow and are well drained, often being droughty.

The Minatare series consists of gray to grayish-brown soils underlain by gray, heavy subsoils. Iron stains and mottlings of gray and

drab are common in the lower subsoil. Both soil and subsoil are highly calcareous, and in many places there are harmful accumulations of alkali. The Minatare soils occur on the first bottom of the North Platte River, and consist of recent alluvium brought down from the White River beds. The surface is nearly level and natural drainage is slow.

The soils of the Laurel series are light brown to gray, underlain by light-gray subsoils. Both soil and subsoil are highly calcareous. Iron-colored stains are common below about 15 inches. There is often a porous stratum of sand and fine gravel in the lower subsoil. The Laurel soils occupy first bottoms, and are composed of sediments derived from the White River and Loup Fork beds, recently deposited along the stream channels. They differ from the Minatare soils in the more loose, open structure of their subsoils. The surface is flat and drainage is generally poor. The soils are subject to overflow at varying intervals.

The surface soils of the Gannett series are dark gray to black and contain a large amount of organic matter, which in many places almost causes a Muck texture. The subsoils are light-brown to grayish-white sandy loams, or sand, generally passing at lower depths into grayish-brown sand. In places a thin substratum of heavy, sandy clay is encountered below 30 inches. The Gannett soils are developed in inclosed pockets or swales in the sandhill region. They represent wind-blown material mixed with fine wash from the hills and modified by the incorporation of organic matter. The surface generally lies but a short distance above the water table and the areas are poorly drained. Their lower portions are often occupied by lakes and marshes.

Areas mapped as Dunesand include grass-covered sandhills and ridges, composed almost entirely of gray sand. The soil is not suited to agriculture on account of its drifting nature when the vegetation is removed.

Riverwash consists of islands and sand bars in the channel of the North Platte River. It is composed of materials ranging from clays to coarse gravels. The areas are subject to inundation, and material is removed and redeposited with each overflow.

Rough broken land consists of dissected areas too rough and stony to permit of cultivation.

In following pages of this report the various soils of Morrill County are described in detail and their relation to agriculture discussed. The distribution of the soils is shown on the accompanying map. In the table below are given the name and the actual and relative extent of each type.

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Dunesand	234,368	25.8	Laurel very fine sandy loam	9,600	1.1
Rough broken land	97,408	10.7	Rosebud loam	6,336	0.7
Rosebud very fine sandy loam	36,992	10.1	Tripp gravelly sandy loam	5,824	0.6
Shallow phase	54,336		Bridgeport silt loam	5,376	0.6
Valentine loamy fine sand	76,992	8.5	Valentine fine sandy loam	5,312	0.6
Bridgeport very fine sandy loam	55,040	6.0	Valentine loamy very fine sand	4,736	0.5
Bridgeport fine sand—rolling phase	52,224	5.8	Rosebud loamy very fine sand	4,480	0.5
Bridgeport loamy very fine sand	35,072	3.9	Tripp silt loam	4,480	0.5
Bridgeport loamy fine sand	20,480	2.3	Minatare very fine sandy loam	4,480	0.5
Tripp loamy fine sand	18,496	2.0	Tripp loam	4,416	0.5
Tripp very fine sandy loam	17,856	2.0	Bridgeport fine sandy loam	4,416	0.5
Gannett very fine sandy loam	17,280	2.0	Rosebud fine sandy loam	4,032	0.4
Minatare silt loam	17,152	1.9	Bridgeport sandy loam	3,200	0.4
Valentine very fine sandy loam	14,592	1.6	Bridgeport gravelly loam	2,688	0.3
Valentine loam	13,056	1.4	Minatare loam	2,304	0.3
Rosebud silt loam	13,056	1.4	Cheyenne sandy loam	2,112	0.2
Tripp loamy very fine sand	11,456	1.3	Laurel loamy sand	2,112	0.2
Rosebud loamy fine sand	11,264	1.2	Epping silt loam	1,664	0.1
Rosebud gravelly sandy loam	10,880	1.2	Dunlap silt loam	1,024	0.1
Riverwash	10,624	1.2			
Gannett loamy fine sand	9,664	1.1	Total	906,880	.....

ROSEBUD GRAVELLY SANDY LOAM.

The Rosebud gravelly sandy loam consists of a brown, loose sandy loam, generally containing an abundance of coarse sand and gravel, consisting of both angular and waterworn fragments of many different crystalline rocks contained in the underlying sandstone formations. The surface 6 inches is often slightly darker in color than the rest of the soil, owing to an accumulation of organic matter. The brownish color of the surface soil extends to a depth of 15 to 20 inches, where the material becomes grayish or light brownish and is notably more calcareous than at the surface. There is very little textural change throughout the 3-foot section.

The soil occurs in small scattered areas throughout the upland in the southern part of the county, and in isolated areas between the sandhill region and the rough, broken land in the northern part. These latter areas lie at the heads of waterways, and vary in size from a few acres to several square miles. The largest area of the type mapped lies in the southeast corner, and covers about 7 square miles. In the southern part of the county the type occupies irregular belts conforming in a general way to the direction of the drainage.

The topography is rolling to hilly, and in general characterized by steep slopes. The run-off and underdrainage are in places excessive.

This type is of small extent, and none of it is under cultivation. The soil is droughty and poorly adapted to farming in a region of

light rainfall. The topography is also unfavorable for cultivation. The soil supports a fairly thick growth of grama, buffalo, and bunch grasses, and blackroot, a sedge, which afford good pasture. Stock raising is the principal industry. The rough topography supplies excellent protection for cattle and horses during severe weather. The land is valued at $8 to $12 an acre, depending upon the improvements.

ROSEBUD LOAMY FINE SAND.

The surface soil of the Rosebud loamy fine sand is a light-brown loamy fine sand, 10 to 14 inches deep. The subsoil is a grayish-brown loamy fine sand to a depth of about 24 inches, below which the color becomes lighter. Fragments of the Arikaree sandstone are common in the soil and subsoil. Both are very incoherent in structure, owing to the small content of silt and organic matter. In some places the material is loose and sandy and closely approaches the Valentine loamy fine sand. It differs from that type in its lower subsoil, which is lighter in color and always calcareous.

Within the type as mapped there occur small areas which are heavier than the typical soil. In places the underlying rock occurs within the 3-foot section, especially in the small isolated bodies in the sand hills where the wind has removed most of the residual material and displaced it with shallow deposits of sand.

The Rosebud loamy fine sand occurs chiefly in the north-central part of the county, where it is closely associated with Dunesand. One of the largest areas lies near Kings Ranch in T. 23 N., R. 50 W. The material has weathered from the gray sandstone of the Arikaree formation, similar to that from which the Rosebud fine sandy loam is derived. The more sandy character of this type may be due to a difference in the parent rock, but is more probably attributable to the washing out of the fine particles or their removal by the wind.

The topography is gently rolling to hilly, and is in most places too rolling to be well adapted to agriculture. Drainage is good, and is almost everywhere subterranean.

The type is not extensive. It is used almost exclusively as pasture and hay land. The same grasses—buffalo, grama, stipa, and sand grass—are found as on the Rosebud fine sandy loam. The coarse sand grasses predominate, and there is some sagebrush. Where the underlying formation is near the surface and the soil is shallow, soap weed, or yucca, is the predominating vegetation. There is very little agriculture on this type, as the light character of the soil favors drifting. The best use for the land at present is grazing. As pasture it ranks with the fine sandy loam and is slightly better than the sandhill areas. The land is valued at $10 to $12 an acre, depending upon the improvements and location.

ROSEBUD LOAMY VERY FINE SAND.

The surface soil of the Rosebud loamy very fine sand is a light-brown to grayish-brown, loose, incoherent loamy very fine sand, 6 to 10 inches deep. The upper 6 inches is somewhat darker in color owing to an accumulation of organic matter. The subsoil is a light-gray to light-brown, highly calcareous very fine sandy loam to very fine sand. Both soil and subsoil are generally deficient in organic matter.

This type occurs chiefly in small, scattered areas in the southern and central parts of the county. The largest and most uniform areas occur in the southern part, in T. 18 N., R. 48 W. A much smaller but very typical body occurs about 1 mile west of Plum Creek, in T. 20 N., R. 49 W. The soil has been derived by weathering from the calcareous sandstone of the Arikaree and Ogallala formations. It has been greatly modified by wind-blown materials and in places has almost lost its residual characteristics.

The topography is rolling to gently undulating, with occasional small areas where the surface is almost flat. Drainage is good, as there is always sufficient slope to carry away the surplus water and the loose, porous subsoil affords excellent underground drainage.

The type is not extensive, and very little of its area is under cultivation. The native vegetation consists of grama grass, buffalo grass, needle grass, and sand grass. Most of the type is included in large stock farms and ranches where the grazing of beef cattle and horses is the principal industry. Its selling price varies from $12 to $20 an acre, depending upon improvements and location with respect to roads and markets.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Rosebud loamy very fine sand:

Mechanical analyses of Rosebud loamy very fine sand.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
372768	Soil	0.3	2.0	1.3	19.3	65.9	8.0	3.3
372769	Subsoil	.4	1.8	2.2	21.4	62.8	7.5	3.7

ROSEBUD FINE SANDY LOAM.

The surface soil of the Rosebud fine sandy loam is a grayish-brown to brown, loose fine sandy loam, averaging about 10 inches in depth. The upper subsoil is a gray to light grayish brown, fine to very fine sandy loam, generally loose and friable, but in some places slightly more compact than the surface soil. At a depth of about 30 inches the subsoil usually becomes a light-gray, highly calcareous silt loam to very fine sandy loam.

Fragments of the Arikaree bedrock are occasionally encountered in the lower part of the 3-foot section. The organic content of the type is comparatively low. In many places on the slopes the loose sand has been washed or blown away and the white calcareous material exposed.

This soil occurs chiefly in the northwestern part of the county. Like the closely associated very fine sandy loam and the other types of the Rosebud series, it has been derived from the weathered sandstones of late Tertiary age. The high sand content is probably due largely to the removal of the finer particles in the process of weathering, and to drifting.

The type lies slightly below the Rosebud very fine sandy loam, and has a rolling to gently undulating surface. The drainage is everywhere thorough, practically all of it being subterranean. This soil is of small extent and very little of it is in cultivation. It is used chiefly for grazing cattle. On the heavier, more level areas, buffalo grass, grama grass, and blackroot predominate, but in the sandier areas stipa or needle grass, and sand grass are more common. About 8 acres are required to support each head of stock when the pasture is supplemented by feeding hay during stormy periods. The cattle are usually shipped in the fall when 2 or 3 years old.

The selling price of this land ranges from $8 to $15 an acre, depending chiefly upon the improvements.

The land is probably best suited to pasture, as there is considerable danger of drifting when the sod is broken.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Rosebud fine sandy loam:

Mechanical analyses of Rosebud fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
372778	Soil	0.2	2.2	3.6	37.9	33.3	14.4	8.5
372779	Subsoil	.2	1.4	2.4	25.8	41.5	21.8	7.3

ROSEBUD VERY FINE SANDY LOAM.

The surface soil of the Rosebud very fine sandy loam is a grayish brown to dark-brown, friable very fine sandy loam, 8 to 12 inches deep. The depth varies with the stage of weathering and the amount of organic matter present. The upper subsoil is a grayish-brown very fine sandy loam, usually containing more silt than than the surface soil and having a slightly compact structure. At about 24 inches the subsoil becomes a light-gray silt loam or very fine sandy loam, which generally continues throughout the 3-foot section. The lower subsoil usually contains much finely divided, white calcareous

material, and in places it is a white, calcareous silt resembling the lower subsoil of the Rosebud silt loam.

The Rosebud very fine sandy loam occurs in irregular bodies over the upland in all parts of the county. The largest and one of the most uniform areas lies in the northwest corner. Two much smaller though typical, bodies are mapped in the vicinity of Simla in the southern part of the county.

The soil is derived from weathered calcareous sandstone of Tertiary age. Bedrock occurs at varying depths and occasionally outcrops along the hillsides. The topography is undulating to rolling, and drainage is everywhere good. Surface channels are not well established, and most of the rainfall is carried away through the porous soil and subsoil.

The type is quite extensive, but only a very small percentage of it is under cultivation, the greater part being used for pasture. The native vegetation includes practically the same grasses that are found on the Rosebud silt loam with the addition of a few species that thrive on more sandy soil, including needle grass and sand grass. The most important crops produced are corn, alfalfa, wheat, and potatoes. Barley, emmer, rye, and beans are grown to a small extent. Wheat and potatoes are the principal cash crops. The grain is hauled to elevators in the towns. Corn and oats are practically all fed on the farms, and considerable corn is shipped in annually for feed. As is generally the case throughout the county, the principal source of farm income is live stock. Cattle are kept on the range throughout the year, but most of the stock is shipped in the fall after coming off the summer pasture. Grade Hereford and Shorthorn are the principal beef types. Dairying is not carried on extensively, but practically every farm has some dairy products to sell.

Yields on this type are about the same as on the heavier soils. Corn yields an average of 20 bushels of grain or 1 to 3½ tons of dry fodder. Wheat yields 8 to 25 bushels per acre, potatoes 50 to 150 bushels, and oats 10 to 30 bushels. The methods of cultivation are practically the same as on the Rosebud silt loam, except that greater care must be taken to prevent the soil from blowing. The selling price of the land ranges from $12 to $25 an acre, depending upon the improvements and distance from markets.

Rosebud very fine sandy loam, shallow phase.—The shallow phase of the Rosebud very fine sandy loam, as mapped in Morrill County, consists of two distinct soils. The more extensive, which is widely distributed over the southern part of the county and in small areas in other parts, has been mapped in Chase and Cheyenne Counties with the Canyon series. It consists of a very fine sandy loam which becomes lighter in color as the parent rock is approached. The subsoil is usually calcareous, but does not have the white lime accumu-

lation characteristic of the Rosebud. The true Rosebud very fine sandy loam, shallow phase, is correctly mapped in a part of the area. It includes much of the phase as mapped north of the North Platte River and areas of it occur throughout the county. In this phase the shallow brown surface soil passes into a white, floury, calcareous subsoil, the result of an accumulation of lime. This white material is underlain at shallow depths by the parent rock. The white calcareous layer may be thin, but it is always present. This soil profile is characteristic of the Rosebud. In the Canyon, the white layer is absent, as sufficient time has not elapsed for its formation, and the brown surface soil extends to the bed rock. Both owe their origin to rapid erosion by which the soil has been removed faster than weathering has broken down the parent rock. The underlying rock is everywhere near the surface and over much of the area it is exposed in patches, giving a white spotted appearance to the hills.

The topography is sharply rolling to hilly, but not badly dissected as in the areas of rough broken land. The true Rosebud soils are found on the rolling topography of the divides but not on the sharply rolling land. The surface is generally rougher and more stony near the channels of the small drainage ways which ramify the entire phase, and on this topography the soil is similar to the Canyon very fine sandy loam as mapped in other areas. Drainage is almost everywhere excessive.

This is not an important soil agriculturally. Most of it is topographically unsuited for farming, and the underlying rock is usually so close to the surface that cultivation is difficult. The phase is used chiefly for pasture. The rough topography affords excellent protection for stock during severe weather. A small tonnage of hay is cut in the more nearly level areas. The native vegetation consists of grama grass, western wheat grass, blackroot, and some yucca. From 8 to 12 acres is sufficient to pasture one cow or steer throughout the year, provided hay is fed during severe weather. The yield of hay ranges from one-fourth to one-half ton per acre, depending upon the rainfall. This land is valued at $10 to $12 an acre, depending upon the improvements and distance from markets.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the typical Rosebud very fine sandy loam:

Mechanical analyses of Rosebud very fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
372792	Soil	0.0	0.3	0.5	30.0	41.4	19.5	8.5
372793	Subsoil	.0	.8	1.4	19.5	51.8	20.8	6.0

ROSEBUD LOAM.

The Rosebud loam consists of 8 to 10 inches of dark grayish brown to brown mellow loam, underlain by an upper subsoil of grayish-brown silty to very fine sandy loam. The color gradually becomes lighter with depth and apparently there is little organic matter below 24 inches, at which depth there is an abrupt change to the light-gray or almost white subsoil. The substratum is highly calcareous.

The type occurs in scattered areas of varying size throughout the upland in the southern part of the county. One of the largest areas lies about 4 miles southeast of Twin Mounds, in T. 17 N., R. 51 W. Another typical area lies about 2½ miles south of the North Platte River, in the southeast corner of the county.

The type has been derived by the disintegration of the underlying sandstone formation. Its surface is rolling to gently undulating, with occasional small almost flat areas. Some of the smaller bodies occur as shallow depressions at the head of draws. All the type has good surface and underdrainage, but it is not subject to erosion.

Owing to its small extent this soil is not very important agriculturally, although it is arable and well suited to farming under semihumid conditions. Most of the type is used as pasture for beef cattle and horses. It supports a fair growth of short native grasses, principally grama and buffalo grass. Western wheat grass is found in the more level situations.

Wheat is the principal cultivated crop. Winter wheat is grown almost exclusively, and the Turkey is the chief variety. There is a small acreage of corn and oats. The yields of all crops show wide variations from year to year, depending mainly upon the amount and distribution of the rainfall. Wheat yields from 10 to 25 or 30 bushels per acre, corn from 10 to 20 bushels, and oats from 15 to 40 bushels. The land sells for $15 to $25 an acre, depending upon the improvements and the location with respect to markets.

The Rosebud loam is better adapted to cultivation than any of the more sandy members of the series. It is easily kept in good tilth, and there is very little danger of soil drifting.

ROSEBUD SILT LOAM.

The Rosebud silt loam, to a depth of 8 to 10 inches, consists of a brown mellow silt loam, which often grades to dark brown in the flatter areas where conditions have favored the accumulation of organic matter. The upper subsoil is a light-brown, mellow silt loam which passes into a gray or light grayish brown, almost pure silt. At about 30 inches a white, floury calcareous silt is usually encountered. Small gravel often occurs at about 36 inches. The

unweathered bedrock lies below the 3-foot level, though in the more rolling areas it often outcrops, giving rise to characteristic white spots on hillsides.

This type occurs chiefly along the southern border of the county, where it represents the northern extremity of the original high plain covering the greater part of Cheyenne County. A small body lies along the northern edge of Morrill County. The soil has been derived by weathering from the calcareous sandstone formation of late Tertiary Age.

The Rosebud silt loam has a topography varying from almost flat to rolling. By far the greater part occupies a smooth or very gently undulating plain. The most rolling areas occur along the heads of streams. Even in the almost flat situations there is sufficient slope to afford an outlet for the surface water, and the porous subsoil and substratum insure ample underdrainage.

This type is not very extensive and for this reason it is not important agriculturally. It is, however, one of the best dry-farming soils in the county, and about 30 per cent of it is under cultivation. The uncultivated areas are used as grazing land and for hay production. The native vegetation includes grama grass, buffalo grass, wire grass, western wheat grass, and blackroot. Wheat, corn, oats, and potatoes are the leading crops, wheat being the principal money crop. A large part of the corn and oats is fed to work stock, and the remainder is used in the production of meat and dairy products for market. Most of the type is included in stock farms and ranches on which beef cattle, principally grade Herefords and Shorthorns, are grazed. A small herd of horses is kept on nearly every ranch. The type supports 40 to 50 head of cattle per square mile the year round. Corn yields 10 to 40 bushels of grain per acre, or 1 to 4 tons of dry fodder. Wheat yields 8 to 30 bushels per acre, potatoes 50 to 150 bushels, and oats 10 to 40 bushels. Native hay yields one-fourth to 1 ton per acre. The higher yields mentioned are produced only under the most favorable conditions.

The Rosebud silt loam when properly managed can easily be kept in a good state of tilth. Under the present methods of tillage the soil retains sufficient moisture to insure fair crops, except during seasons of prolonged drought. When plowed wet it has a slight tendency to clod, but the clods are easily broken down. No definite rotation is followed, as the soil is new and in no immediate danger of becoming exhausted. The land is generally plowed every three or four years. Small grains are usually drilled in on old stubble or corn ground, and corn usually follows a small grain, although it is often planted on broken sod. The corn is listed in, as the moisture conditions are better than where level planting is done.

The selling price of land of the Rosebud silt loam ranges from $30 to $60 an acre, depending upon the improvements.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Rosebud silt loam:

Mechanical analyses of Rosebud silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
372739	Soil	0.2	1.1	0.6	6.8	50.1	34.4	7.0
372740	Subsoil	.2	.6	.4	6.2	52.0	32.6	8.2

DUNLAP SILT LOAM.

The Dunlap silt loam, to a depth of 10 to 12 inches is a dark grayish brown, friable silt loam. In small areas where the topography has favored the accumulation of organic matter the surface 8 inches is almost black. The upper subsoil passes gradually from a heavy silt loam into a dark-brown silty clay loam. At a depth of 20 to 30 inches this grades into a dark-brown, stiff, compact, almost impervious silty clay loam or clay. When moist the lower subsoil becomes almost black in color. In a few spots the material below 30 inches is a light-gray to almost white, floury, calcareous silt or silty clay, not unlike the lower subsoil of the Rosebud series.

The Dunlap silt loam occurs in small isolated bodies in the southwestern part of the county, representing part of the northern extremity of the original high plains which covers much of Cheyenne county. The type occupies shallow depressions in the otherwise flat country. It has been derived from the light-colored sandstones and clays of the underlying formation, weathered under conditions of poor drainage. This process has resulted in the concentration of clay in the subsoil and in the removal of much of the lime from the surface soil and upper subsoil. The topography is flat to gently undulating. Local drainage has not been thoroughly established, but owing to the light rainfall water seldom accumulates on the surface.

This type is of very small extent and of little importance agriculturally. It is all used for pasture. The native vegetation consists of western wheat grass, grama grass, buffalo grass, and blackroot. The soil will support from 40 to 50 head of cattle per section throughout the year. The land is held at $30 to $40 an acre depending upon improvements.

The Dunlap silt loam, when occurring in areas of large extent, as in Box Butte, Dawes, and Cheyenne Counties, is one of the most valuable dry land farming soils of western Nebraska.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Dunlap silt loam:

Mechanical analyses of Dunlap silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
372735	Soil	0.1	0.7	0.8	4.8	35.7	46.7	11.3
372736	Subsoil	.4	1.0	1.2	5.2	33.4	45.8	13.1

EPPPING SILT LOAM.

The surface soil of the Epping silt loam is a gray to light grayish brown silt loam, 6 to 10 inches deep. The upper subsoil is usually lighter in color. Below 24 inches the subsoil becomes a gray, loose, floury silt to silty clay loam. In some places the compact, unweathered Brule clay is encountered at less than 3 feet below the surface. The type is deficient in organic matter. Both soil and subsoil are calcareous.

This type occurs in small, isolated areas, generally on the steep slopes adjacent to areas of rough broken land. Small bodies occasionally occur within the alluvial areas, especially where recent erosion has removed the alluvial and colluvial material and left the Brule clay partly exposed. The largest and most typical body of the type occurs in the vicinity of Twin Mounds in T. 18 N., R. 52 W. Another relatively large body lies about 4 miles southeast of Chimney Rock in T. 20 N., R. 52 W. Small areas may be seen in the vicinity of Courthouse and Jail Rocks.

The Epping silt loam consists of residual material derived from the weathering of the underlying Brule formation. This is a slightly consolidated, pale-pink or almost white clay, which gives the soil its light-colored, floury character. The topography of this type varies widely, from steeply rolling slopes to almost level flats. In a few places badly eroded patches of Brule clay are exposed, giving locally a typical bad-land topography. The soil is well drained. In the level tracts there are often local surface irregularities such as washes and gullies which carry off the surplus water.

Practically none of the Epping silt loam is under cultivation. It is slightly droughty and owing to its small extent does not rank as an agricultural soil. The type is used exclusively as pasture land. Its native vegetation consists mainly of grama and buffalo grass. The soil will support 20 to 30 head of cattle to the square mile throughout the year. It does not stand as heavy grazing as the surrounding types, on account of its droughty character.

Land of this type is valued at $10 to $12 an acre, depending upon the topography and improvements.

VALENTINE LOAMY FINE SAND.

The Valentine loamy fine sand, to a depth of 8 to 12 inches, is a grayish-brown to brown, loose, friable loamy fine sand. The depth and color varies with the amount of organic matter present. The surface 6 inches contains sufficient organic matter to give the soil its loamy characteristic, but it is usually deficient in this material. From 12 to 18 inches the subsoil in places is fairly compact, but crushes into a loose, friable fine sand. Below 18 inches it becomes an incoherent, light yellowish brown to light-brown fine sand, the lighter color being due to a deficiency in organic matter.

In some included areas small waterworn gravel occurs on the surface and in the soil and subsoil. These areas probably represent shallow soil overlying residual material, or are due to islandlike exposures of the Arikaree formation projecting above the wind-laid material.

The Valentine loamy fine sand occurs chiefly in the northern part of the county contiguous to the large areas of Dunesand. The areas vary in size from a few acres to 2 or 3 square miles. Small bodies lie south of the North Platte River. A large uniform area occurs along the Bridgeport-Alliance Road, in T. 23 N., R. 50 W. One typical area of the gravelly variation is found along the Broadwater-Alliance Road in T. 20 N., R. 48 W., and another 2 miles northwest of Angora.

The origin of the Valentine loamy fine sand is difficult to determine. It was derived originally from Tertiary rocks, but the material has been shifted by wind and water, redeposited, and subsequently weathered. Much of the type appears to be in part colluvial material deposited in depressed areas where the accumulation of organic matter has been favored.

This soil generally occupies depressions in the sandhill valleys, but south of the North Platte River it is often slightly elevated above the surrounding types. Its surface is gently undulating, broken by small ridges and knolls composed of sand from the surrounding types. Surface drainage has not been established, as the rainfall readily sinks into the porous sand, and there is practically no run-off.

Very little of the type is under cultivation, owing to the danger of drifting. Small areas are cultivated in the deeper depressions and valleys, where crops can get moisture from subsurface water.

The native vegetation consists of stipa, grama, and sand grasses, with some sagebrush. Hay is the most important crop, the type producing a heavy growth of grasses. The soil is easily tilled and can be cultivated immediately after heavy rains. On the cultivated areas the principal crops are corn and potatoes. Corn yields 10 to 35 bushels per acre, potatoes 50 to 100 bushels, and hay from one-fourth to three-fourths ton per acre, depending upon the rainfall. The grasses on this type will support 25 to 36 head of cattle per square mile the year round.

This land sells for $12 to $20 an acre, depending upon the improvements and distance from market. In cultivating it great care must be taken to keep the soil from drifting. It is advisable to break the soil no more frequently than is absolutely necessary to keep down injurious weeds.

VALENTINE LOAMY VERY FINE SAND.

The Valentine loamy very fine sand, to a depth of 8 to 16 inches, is a brown to dark grayish brown, loose, friable loamy very fine sand. The depth varies with the content of organic matter, but averages 10 inches. The slightly compact layer found in the Valentine loamy fine sand does not occur in this type, and the subsoil below 16 inches is a loose, friable, brown to dark-brown loamy very fine sand. The type is of slightly darker color than the Valentine loamy fine sand, probably owing to its larger content of silt and organic matter.

This soil is most extensively developed in one area about 3 miles southeast of Angora. A small area lies about 2½ miles southwest of Chimney Rock, along the western county line. Like the Valentine loamy fine sand, the type probably represents intermixed water and wind deposits which have been subjected to weathering for a considerable time. The topography varies from level to gently undulating, with occasional depressions and low hummocks due to wind action. Drainage is everywhere through subterranean channels. The native vegetation on this soil consist of stipa and sand grasses, with some buffalo and grama grass. All the type is included in large farms or ranches where the raising of cattle and horses is the principal industry. Hay yields from one-fourth to three-fourths ton per acre, depending upon the season. The grasses will support 30 to 40 head of cattle per square mile the year round. This land sells for $10 to $15 an acre, depending upon the improvements.

The Valentine loamy very fine sand should probably be left with its growth of native grasses, as most of it lies in a relatively exposed position and there is danger of drifting when the sod is broken and the soil becomes dry.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Valentine loamy very fine sand:

Mechanical analyses of Valentine loamy very fine sand.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
372788	Soil	0.2	2.4	4.8	37.1	33.7	17.6	4.2
372789	Subsoil	.1	3.3	5.8	40.9	30.4	13.3	6.2

VALENTINE FINE SANDY LOAM.

The Valentine fine sandy loam, to an average depth of 10 inches, consists of a grayish-brown to brown, loose, friable fine sandy loam. Small gravel is often thinly scattered over the surface. The material gradually becomes lighter in color with depth, and at about 24 inches is a light grayish brown to almost gray, fine sandy loam. Both soil and subsoil are deficient in organic matter. The type differs from the Rosebud fine sandy loam chiefly in the noncalcareous nature of the subsoil.

The Valentine fine sandy loam occurs in a few scattered areas over the upland in the eastern and northwestern parts of the county. The areas are irregular in shape and vary in size from a few acres to 2 or 3 square miles. The exact origin of this soil has not been determined. It has probably been derived partly by weathering from the sandy strata of the Tertiary and partly by wind action. Its topography is flat to gently undulating. The type usually occupies shallow depressions, somewhat lower in elevation than the other soils of the series. Drainage is adequate. The porous subsoil absorbs most of the light rainfall.

Only a very small proportion of this soil is in cultivation. It is well adapted to crops, however, and fair yields are obtained in favorable seasons. The type is subject to wind erosion when plowed, but does not drift so badly as the Valentine loamy fine sand.

Most of this soil is included in stock farms on which cattle raising is the principal industry. The native vegetation consists of grama grass, buffalo grass, needle grass, and coarse sand grasses. From 10 to 15 acres are required to pasture a cow or steer throughout the year when hay is added to the ration during severe weather. On the cultivated parts of the type corn, wheat, and oats are the principal crops. Corn yields 10 to 20 bushels per acre, wheat 10 to 30 bushels, and oats 15 to 40 bushels. The land sells for $8 to $15 an acre, the price depending chiefly upon the improvements.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Valentine fine sandy loam:

Mechanical analyses of Valentine fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
372770	Soil	0.2	3.0	5.4	32.3	34.7	18.9	5.5
372771	Subsoil	.0	1.9	4.0	30.9	39.9	14.7	8.7

VALENTINE VERY FINE SANDY LOAM.

The surface soil of the Valentine very fine sandy loam is a dark-brown to dark grayish brown, loose, friable very fine sandy loam, 8 to 10 inches deep. It generally contains a relatively large proportion of silt. The organic content of the surface 6 inches is comparatively high, giving that portion of the soil a darker color than the remainder. The subsoil gradually becomes lighter in color, more sandy, and grades at about 30 inches into a light grayish brown very fine sandy loam to very fine sand. Both soil and subsoil are non-calcareous.

The largest and most typical areas of this soil occur just north of the Rough broken land in T. 19 N., R. 47 W. A large body lies in the vicinity of Lynn in T. 21 N., R. 49 W., and smaller bodies are scattered throughout the upland in this portion of the county. The type has probably been derived in much the same manner as the Valentine loam. Its topography is almost flat or very gently undulating, and surface drainage is not well established. The porous subsoil, however, absorbs the light rainfall and water seldom accumulates on the surface.

This soil is not extensive, but it ranks very favorably in crop production with the Rosebud very fine sandy loam, and is one of the most important types in the Valentine series. About 15 per cent of it is in cultivation. The remainder is used for pasture and hay land. The native vegetation consists of buffalo, grama, and western wheat grasses, and blackroot, with some stipa grass or needle grass. The most important crops are wheat, corn, oats, and potatoes. Wheat constitutes the cash crop, the grain being marketed in the towns or hauled directly to the railroad for shipment. All the corn and oats are fed on the farm. Potatoes are only grown in sufficient quantity for farm use and for seed. Cattle and horses are the principal sources of farm income. The cattle are generally shipped to the Omaha, Chicago, or Kansas City market, while most of the horses go to Grand Island. The methods of cultivation and the crop yields are about the same as on the Rosebud very fine sandy loam.

This land is valued at $15 to $20 an acre, depending on the improvements and the location with respect to roads and markets. Nearly all the type is suited to agriculture. The topography is level and the drainage good. More of the land should be in cultivation, as the returns from crop production are greater than from the present system of grazing.

The following table gives the results of mechanical analysis of samples of the soil and subsoil of the Valentine very fine sandy loam:

Mechanical analyses of Valentine very fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
372764	Soil	0.2	3.2	4.8	23.9	46.0	15.1	6.5
372765	Subsoil	.4	5.4	6.1	30.0	38.2	12.3	7.5

VALENTINE LOAM.

The surface soil of the Valentine loam is a dark grayish brown, loose, friable loam, 8 to 10 inches deep, containing some small gravel. The topography has favored the accumulation of organic matter, which gives the soil its dark color. The subsoil gradually becomes lighter in color and more sandy, and at about 24 inches grades into a loose, friable, light-brown loam to very fine sandy loam. The type is not highly calcareous. In places the upper subsoil between 12 and 18 inches is slightly compact, owing to a zonal concentration of the finer soil particles by translocation. This condition, however, is not common, and the type is fairly uniform.

One of the largest areas of this soil occurs in the east-central part of the county in T. 20 N., R. 47 W. Another large body lies just west of the Broadwater-Alliance Road in T. 20 N., R. 48 W. Smaller bodies occur scattered throughout the upland north of the North Platte River.

The Valentine loam probably consists of originally residual material, which has been reworked by wind and water until it has lost most of its former characteristics. That weathering has taken place for a considerable length of time is indicated by the lack of calcareous material in the subsoil. The topography is flat to gently undulating, but there is generally sufficient slope to afford adequate run-off, and in the more nearly level situations the loose, porous subsoil absorbs the surplus water.

This type is of relatively small extent, although it is one of the most extensive soils of the Valentine series. About 15 per cent of its area is under cultivation, the remainder being used as pasture and

hay land. The native vegetation consists of grama, buffalo, and western wheat grasses and blackroot, and the land commonly has a carrying capacity of one cow or steer to 15 or 20 acres. Native hay yields one-fourth to one-half ton per acre. Wheat, chiefly of the winter varieties, is the principal cash crop on this soil. Corn, oats, and potatoes are grown to a less extent. Yields of wheat range from 10 to 30 bushels per acre, depending upon the rainfall. Owing to the short growing season, only the early-maturing varieties of corn are planted. These yield 15 to 30 bushels per acre. In short seasons the grain fails to mature, and during the driest years there is scarcely any fodder. Oats yield 15 to 40 bushels per acre. Kherson and Swedish Select are the principal varieties.

The sod land of this type is generally broken to a depth of about 4 inches. Tractors are used quite extensively in breaking. As soon as possible after breaking the land is disked in order to fill up the furrow slices and prevent excessive loss of moisture. The soil under cultivation is kept only fairly well pulverized, owing to the danger of drifting. Under favorable moisture conditions the soil is mellow and easily worked, but after periods of drought it becomes more compact and the preparation of a good seed bed is difficult. This land sells for $12 to $20 an acre, depending upon the improvements.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Valentine loam:

Mechanical analyses of Valentine loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
372754	Soil	1.6	7.8	6.8	31.1	31.0	14.9	6.8
372755	Subsoil	1.4	9.6	8.0	32.6	28.2	12.6	7.8

BRIDGEPORT GRAVELLY LOAM.

The surface soil of the Bridgeport gravelly loam is a light-brown to brown, loose, incoherent gravelly loam, 8 to 10 inches deep. The immediate surface layer is much darker than the lower portion of the surface soil, owing to an abundance of organic matter. Much small gravel occurs on the surface. There is a gradual change in color and texture within the subsoil, which at about 24 inches becomes a gray to grayish-brown, loose, incoherent sandy loam to very fine sandy loam. Much small gravel is often encountered in the lower stratum. The subsoil is generally deficient in organic matter and is highly calcareous.

The Bridgeport gravelly loam occurs in a few small, scattered areas in the southwestern part of the county. A very typical area

lies about 2 miles southwest of the Randall Ranch in T. 18 N., R. 52 W., and small areas occur along Lawrence Fork and its tributaries. The type consists of colluvial material washed down from the uplands. It topography is gently rolling to undulating, with a decided slope toward the main streams. Drainage is good and often excessive, owing to the porous subsoil and the slope.

This soil is unimportant agriculturally, on account of its small extent and distance from market. It is used exclusively as pasture and hay land. The native vegetation consists of buffalo grass, a sedge called blackroot grass, and some western wheat grass. These will support 25 to 35 head of cattle per square mile the year round. The land is valued at $10 to $15 an acre, depending upon the improvements.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Bridgeport gravelly loam:

Mechanical analyses of Bridgeport gravelly loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
372745	Soil	5.6	7.8	3.8	23.0	36.8	18.1	4.8
372746	Subsoil	2.8	7.7	5.7	24.2	35.5	19.4	4.9

BRIDGEPORT FINE SAND, ROLLING PHASE.

The Bridgeport fine sand, rolling phase, consists of a loose, incoherent, gray, fine sand showing little difference in color or texture throughout the 3-foot section. The lower subsoil is calcareous. Both soil and subsoil are deficient in organic matter and are not easily built up. The type differs from the Valentine loamy fine sand in the occurrence here and there of pebbles over the surface and in the calcareous nature of the lower subsoil. It also contains a much smaller proportion of organic matter.

This soil occurs extensively over the colluvial slopes on both sides of the North Platte River. It covers several square miles in Ts. 19 and 20 N., R. 49 W. Two smaller though typical bodies are mapped along the Belmont Canal in T. 18 N., R. 48 W. The soil appears to be composed almost entirely of wind-blown material which has probably been somewhat modified by colluvial wash, as is indicated by the gravel occasionally found on the surface. The topography is rolling to billowy, modified by occasional low depressions or flats, and evidences of wind action are conspicuous. At present, however, the soil rarely drifts unless the sod is broken. There is practically no surface drainage within this type, the loose, porous sand readily absorbing the precipitation.

Practically none of the type is under cultivation. It is not well adapted to irrigation on account of its rough topography, and it is used almost exclusively for pasture land. Some hay is cut on the more level areas. The principal breeds of cattle maintained on the ranches are Hereford and Shorthorn. The type supports 20 to 30 head of cattle per square mile throughout the year, the stock generally being fed hay during severe weather.

The land is valued at $10 to $15 an acre, depending upon the improvements and distance from market.

This soil should not be used for cultivated crops, as it drifts badly when plowed. It may be possible, however, to obtain fair yields of alfalfa under irrigation on the more nearly level portions.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Bridgeport fine sand, rolling phase:

Mechanical analyses of Bridgeport fine sand, rolling phase.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
372752	Soil	0.8	6.6	7.5	39.9	42.1	1.3	1.8
372753	Subsoil	.7	7.8	10.9	43.7	32.7	1.7	2.6

BRIDGEPORT LOAMY FINE SAND.

The Bridgeport loamy fine sand, to a depth of 8 to 10 inches, is an incoherent, loose loamy fine sand, of light-brown to brown color. The surface 6 inches is somewhat darker than the lower portion, owing to a small content of organic matter. Gravel is found in places on the surface. The upper subsoil is a light grayish brown to gray, loamy fine sand to fine sand. Below about 24 inches the subsoil becomes a very loose, incoherent, gray to light-gray fine sand. Both soil and subsoil contain considerable very fine sand. The type is low in organic matter and the organic content is not easily built up. The lower subsoil is calcareous. This type differs from the Valentine loamy fine sand chiefly in the gravel scattered over the surface and in the calcareous nature of the lower subsoil.

The Bridgeport loamy fine sand occurs in scattered areas over the colluvial slopes on both sides of the North Platte River. The areas vary in size from 160 acres to 2 or 3 square miles. One of the largest lies along Lower Dugout Creek in T. 19 N., R. 48 W. Another large body lies just south of the North Platte River in T. 18 N., R. 47 W. A very typical, though much smaller, area is mapped north of Twin Mounds in T. 18 N., R. 52 W. Like the other soils of the Bridge-

port series, the type is composed of material which has been blown by the wind or washed down by water from the adjoining upland. Much of the soil has undoubtedly been carried down during torrential rains. The greater part of the type, however, has been so modified by wind-blown material that its exact mode of formation is uncertain.

The greater part of this type occupies a smooth, relatively flat slope, with occasional depressions and low hummocks. Drainage is good and in many places excessive. Very few of the smaller drainage ways are continuous, but the water sinks into the porous subsoil and passes underground to the main stream.

This is not a very extensive type, and practically none of it is under cultivation. The native vegetation consists of sand grass, stipa grass, grama grass, and some western wheat grass. Most of the type is included in large ranches and stock farms on which the raising of beef cattle is the principal occupation. Grade Hereford and Shorthorn cattle predominate. A small herd of horses is kept on nearly every ranch. The type will support 25 to 30 head of stock per square mile the year round.

This land ranges in selling price from $10 to $20 an acre, depending upon the improvements and distance from market.

A large part of the Bridgeport loamy fine sand is very well suited for irrigation, and it is doubtful if the sod should be broken unless irrigation is carried on, as the soil drifts so badly when plowed under dry conditions that farming is almost impossible.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Bridgeport loamy fine sand:

Mechanical analyses of Bridgeport loamy fine sand.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
372721	Soil	0.7	5.5	7.1	42.5	31.7	9.0	3.6
372722	Subsoil	.4	2.8	4.4	46.2	35.7	6.9	3.7

BRIDGEPORT LOAMY VERY FINE SAND.

The Bridgeport loamy very fine sand consists of loose, incoherent, light-brown to brown loamy very fine sand, which becomes slightly lighter in color below 30 inches. There is no textual change within the 3-foot section. The lower subsoil is calcareous. Both soil and subsoil are generally deficient in organic matter. Small areas of Bridgeport very fine sandy loam occur throughout this type, but they are too inextensive to indicate on the map.

The Bridgeport loamy very fine sand occurs quite extensively on the long colluvial slopes leading from the upland to the low terraces and flood plains of the North Platte River. A large uniform area occurs in Ts. 21 and 22 N., Rs. 51 and 52 W. A typical but small area is mapped west of Plum Creek in T. 20 N., R. 49 W. Small areas occur scattered over the colluvial slopes throughout the county.

This soil, like the very fine sandy loam, consists of colluvial and alluvial material washed down from the upland on both sides of the North Platte River. Wind also has played an important part in its formation. It is of very recent origin and has not yet developed the light-colored subsoil so characteristic of the older types. The topography is rolling to gently undulating, with occasional low hummocks and shallow depressions caused by wind action. Drainage is good and in places excessive. Many of the smaller drainage ways disappear shortly after entering this type, their water passing through the loose, porous substratum and reaching the main stream through subterranean channels.

About 30 per cent of this soil is under cultivation, and it is very important in the agriculture of the county. About 30 per cent of the cultivated land is under irrigation. The most important crops are beets, potatoes, wheat, and oats. Beets are the principal cash crop. Most of the type is included in ranches and used for grazing stock or for hay production. It is capable of supporting 25 to 35 head of cattle per square mile the year round. Under dry-farming methods potatoes yield 50 to 100 bushels per acre, wheat 8 to 20 bushels, oats 15 to 30 bushels, and native hay one-fourth to one-half ton. The yields on the irrigated areas compare very favorably with those obtained on the Bridgeport and Tripp very fine sandy loams.

As on all the soils of this region, no definite system of crop rotation is practiced. It is found, however, that better yields of sugar beets are obtained by following a 3-year rotation which includes a small grain. Irrigated areas are handled in the same manner as the Tripp very fine sandy loam of the Bayard terrace. The land ranges in value from $10 to $100 an acre, depending upon the irrigation development, improvements, and distance from market. The higher values apply to irrigated sections well located with respect to roads and markets.

The Bridgeport loamy very fine sand is a very productive soil, well suited to irrigation. Like the loamy very fine sand, it includes large areas whose productiveness would be greatly increased by irrigation.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Bridgeport loamy very fine sand:

Mechanical analyses of Bridgeport loamy very fine sand.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
372760	Soil	0.0	0.2	0.3	12.5	69.0	13.7	3.5
372761	Subsoil	.0	.3	.3	11.8	69.8	12.5	4.7

BRIDGEPORT SANDY LOAM.

The Bridgeport sandy loam, to an average depth of about 12 inches, is a light-brown to brown sandy loam, slightly tinged with gray. It often contains considerable coarse sand and fine gravel. The surface 6 inches usually is slightly darker, owing to a somewhat larger content of organic matter. The subsoil consists of a light-brown to grayish-brown sandy loam to sand, which gradually becomes lighter in color with depth. In some places a substratum of small gravel lies below 30 inches. The lower subsoil is not generally calcareous.

This type is of small extent. It occurs north of the North Platte River on the slopes leading from the upland in the eastern part of the county. A typical area is mapped about one-half mile southeast of Kuhn. The type consists of colluvial and alluvial material from the adjoining uplands. Near the edge of the upland it is rough and gullied, but the surface becomes slightly rolling to almost flat along the southern border of the type. The drainage is generally excessive, owing to the slope and the porous subsoil. It is difficult to trace the drainage channels across the southern part of the type, as the water sinks into the sand.

The Bridgeport sandy loam is unimportant agriculturally, owing to its small extent. It is used almost exclusively as pasture land, only a very small part being under cultivation. The native vegetation consists of sand grass, stipa grass, and grama grass, and is capable of supporting 25 to 35 head of cattle per square mile throughout the year. The rougher areas afford excellent protection to stock during severe weather.

Land of this type ranges in price from $7 to $15 an acre, and is generally sold in connection with the surrounding soils. The more level areas could be made to produce fairly good crops by proper cultivation, but the greater part of the type is too rough to cultivate and should be used as pasture land.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Bridgeport sandy loam:

Mechanical analyses of Bridgeport sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
372703	Soil	7.9	17.2	12.0	25.0	27.7	7.2	3.2
372704	Subsoil	6.5	22.8	12.2	23.6	25.4	6.3	3.3

BRIDGEPORT FINE SANDY LOAM.

The Bridgeport fine sandy loam consists of a brown, loose, friable fine, sandy loam, with practically no change in color or texture throughout the 3-foot section. The immediate surface layer, however, is considerably darker than the rest of the soil, as it contains a large amount of organic matter. The subsoil is deficient in this material, and it is highly calcareous. The type is not so subject to wind erosion as the Bridgeport loamy fine sand, as its larger content of silt organic matter, and very fine sand gives it greater coherency.

The Bridgeport fine sandy loam occurs in scattered areas on the colluvial slopes leading from the upland to the North Platte River flood plain on both sides of the stream. One of the largest and most uniform bodies occurs along the Chicago, Burlington & Quincy Railroad just south of Alden. Another uniform though smaller body lies on the east side of Upper Dugout Creek in T. 21 N., R. 50 W. The type is rolling to gently undulating and both surface and subsurface drainage are good.

This type is inextensive and of little importance agriculturally. Practically none of it is under cultivation. The native vegetation consists of grama grass, western wheat grass, stipa grass, and sand grass, and blackroot and yields from one-fourth to one-half ton of hay per acre. The type will support 20 to 35 head of cattle per square mile the year round. This land sells for $12 to $15 an acre.

Most of the type is admirably adapted to irrigation, as the porous subsoil would afford excellent drainage and prevent accumulations of alkali almost indefinitely. Under irrigation this type could be made as productive as any of the Tripp soils.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Bridgeport fine sandy loam:

Mechanical analyses of Bridgeport fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
372727	Soil	0.9	9.2	11.0	33.3	24.2	15.5	5.7
372728	Subsoil	.9	7.9	8.1	37.1	27.0	12.7	6.5

BRIDGEPORT VERY FINE SANDY LOAM.

To a depth of 10 to 16 inches the Bridgeport very fine sandy loam is a loose, mellow, brown to light grayish brown very fine sandy loam to silt loam. In the surface 6 inches there is generally a large content of organic matter, which causes a darker color. There is little change in color or texture until a depth of 24 inches is reached, the lower subsoil being a light gray, loose, friable very fine sandy loam, of a calcareous nature.

This is a comparatively extensive type. It occurs in areas of varying size, scattered over the valley slopes along the North Platte River and its larger tributaries. Probably the largest area is that mapped just north of the Bayard terrace in Ts. 21 and 22 N., Rs. 51 and 52 W. This area, however, is not uniform throughout, as many other soil types are included within its border. A smaller though very typical area is mapped along the Broadwater-Sidney Road in T. 18 N., R. 49 W.

Colluvial and alluvial wash from the adjoining upland, greatly modified by wind-blown material chiefly from the Arikaree formation, has given rise to this type. It is of comparatively recent origin, as is shown by the uniformity in color and texture throughout the soil and subsoil. By far the greater part of the type occupies a smooth, undulating slope, and even the more nearly level areas slope gently toward the main stream. Drainage is consequently adequate. Even though surface channels were lacking the porous subsoil would carry off all surplus waters.

Lying within the Bridgeport very fine sandy loam are small low-lying areas in which seepage water from the higher irrigated districts has collected, causing the soil to be moist throughout the 3-foot section. Also, the surface 12 to 14 inches of soil contains more organic matter than is found in the typical areas, and is consequently considerably darker. Drainage canals are being established to carry off this surplus water and in a few years the poorly drained area will all be reclaimed for crop production.

Owing to its large extent the Bridgeport very fine sandy loam is an important agricultural soil. About 40 per cent of it is under cultivation, and about half the cultivated area is irrigated. Beets, potatoes, wheat, corn, oats, and alfalfa are the principal crops, beets and potatoes being the principal sources of income. All of the corn, oats, and alfalfa produced is fed to stock on the farm or sold locally for feed. Beets are shipped to the sugar factories at Bayard, and at Gering, and Scotts Bluff, in Scotts Bluff County, and potatoes are shipped to eastern and southern markets.

Over half the total area of the type is included in stock farms or ranches on which beef cattle, principally Hereford and Short-

horn grades, are grazed. Horses are raised on nearly every ranch. Many nutritious plants, including grama, buffalo, and stipa grasses and blackroot grow on this soil. In the poorly drained situations rushes and sedges are commonly found. From 30 to 40 head of stock to the square mile can be maintained the year round. On the irrigated portions of this type native hay yields one-fourth to one-half ton per acre, depending upon the season.

In the dry-farming areas corn yields 10 to 30 bushels of grain, or 1 to 3 tons of dry forage when cut for fodder. Wheat yields 8 to 25 bushels per acre, Irish potatoes 50 to 150 bushels, and oats 20 to 45 bushels. Sugar beets are grown only on the irrigated part of the type. They yield 12 to 15 tons per acre. Under irrigation corn yields 20 to 40 bushels per acre, or 1½ to 4 tons of dry forage; wheat 15 to 30 bushels, potatoes 100 to 200 bushels, oats 20 to 60 bushels, and alfalfa about 4 tons per season from three cuttings. No definite system of rotation is followed on this type, but sugar beets are generally grown 3 years in succession, followed by 3 years of other crops. Farming methods are very similar to those practiced on the Tripp very fine sandy loam of the Bayard terrace.

The selling price of this land ranges from $12 to $100 an acre, depending upon the improvements, distance from market, and irrigation possibilities. In the remoter situations the price is based almost entirely on the value of the land for hay and pasture.

The Bridgeport very fine sandy loam is naturally productive, and under irrigation it yields almost as well as the better types of the Tripp series. Much of the land now used for hay and pasture is well suited to irrigation, and when all of it is irrigated this will be one of the most important soils in the county.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Bridgeport very fine sandy loam:

Mechanical analyses of Bridgeport very fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
372750	Soil	1.7	3.0	2.5	21.2	49.6	15.3	6.9
372751	Subsoil	1.2	2.1	2.2	20.1	45.9	23.1	5.7

BRIDGEPORT SILT LOAM.

To a depth of 10 to 12 inches the Bridgeport silt loam is a grayish-brown to dark-gray, mellow silt loam. In general the surface 6 inches is rich in organic matter and much darker in color than the lower portion. There is practically no textural change throughout

the 3-foot section. Below 24 inches the lower subsoil becomes highly calcareous and slightly compact, but the material is easily broken down into a loose, friable silt to silt loam. This type is not so subject to wind erosion as the other members of the series, owing to its finer texture and larger content of organic matter. It retains moisture well and is an excellent soil for dry farming.

The Bridgeport silt loam occurs chiefly in depressions or coves on the colluvial slopes in the southern and southwestern parts of the county. These vary in size from a few acres to about 3 square miles. A very typical and uniform area lies about 3 miles southwest of Roundhouse Rock in T. 18 N., R. 51 W. Another typical though much smaller body occurs just north of Deep Hole Creek in T. 18 N., R. 49 W.

The type consists of alluvial and colluvial material transported from the uplands. The washing down of the fine silty material from the exposed Brule formation along the northern edge of the upland probably accounts for the heavy silty texture. The surface is almost flat to very gently undulating, but there is generally sufficient slope to carry off all surplus water, and the porous subsoil affords ample underground drainage.

The type is not extensive and for this reason is not important agriculturally. About 15 per cent of it is under cultivation and the remainder is used as pasture for beef cattle and horses and for hay production. The native vegetation consists of western wheat grass, grama grass, buffalo grass, and blackroot, and yields one-fourth to one-half ton of hay per acre, depending on the rainfall. Wheat is the principal cash crop. Potatoes, corn, and oats are also grown. Wheat yields 10 to 30 bushels per acre, potatoes 50 to 100 bushels, corn 10 to 25 bushels, and oats 20 to 50 bushels. The land is valued at $15 to $25 an acre, depending upon the improvements and location.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Bridgeport silt loam:

Mechanical analyses of Bridgeport silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
372715	Soil	0.5	1.8	1.4	6.1	47.0	39.1	4.4
372716	Subsoil	1.1	4.0	2.4	8.1	38.0	41.3	5.4

TRIPP GRAVELLY SANDY LOAM.

The areas mapped as Tripp gravelly sandy loam consist of gravel deposits, and patches of gravelly sand and gravelly loam. The material varies widely, but the gravelly sand is the most extensively dis-

tributed. The sands range in grade from medium to coarse. The gravel varies from small pebbles to stones 2 or 3 inches in diameter.

The Tripp gravelly sandy loam occurs among the older deposits of the North Platte River, in two topographic situations. In its older variation it occupies gravel-covered hills and ridges scattered over the slopes leading from the upland to the terraces. Most of these areas lie north of the river. The soil represents remnants of a much older and higher terrace than the one north of Bayard, deposited when the North Platte River had cut through the Loup Fork sandstones only and was flowing in a channel which lay on the Brule formation. This former position of the river is marked by shallow deposits of sand, gravel, and waterworn bowlders, which cap the tops of hills and ridges at a common level. The Brule clay underlying those portions of the channel which were not protected by a gravel deposit has been eroded by wind and water, leaving the protected portions as hills and ridges. This variation of the type has very little agricultural value. Where the deposit is thin some grasses have obtained a foothold, affording fair pasturage. The areas are locally used as a source of sand and gravel for building purposes.

The younger variation is composed of a mantle of sand, gravelly sand, and gravelly loam. In the lower situations there is often an underlying stratum of sand. The type occurs in long, narrow areas covering the slope between the low and high terraces, and the material probably extends under the high or Bayard terrace for a considerable distance. The type lies practically parallel to the present channel of the North Platte River, with occasional narrow extensions along the slopes of streams issuing from the upland on the north. Only a few isolated areas are found south of the river in the same position as those on the north side. This variation of the type is included in pasture lands and also furnishes sand and gravel for building purposes.

The selling price of areas of the Tripp gravelly sandy loam is governed by the price of farms within which the type occurs. It generally reduces the value of farms.

TRIPP LOAMY FINE SAND.

The surface soil of the Tripp loamy fine sand is a light-brown to brown loamy fine sand, 16 to 24 inches deep. The upper 6 inches is somewhat darker than the lower portion, owing to a higher content of organic matter. The subsoil is generally lighter in color than the soil. Over most of the type it is a grayish-brown to yellowish-brown, loamy fine sand. In many places, however, the soil shows practically no change within the 3-foot section.

The Tripp loamy fine sand occurs on the low terrace of the North Platte River and along Pumpkin Creek. The areas are irregular in shape and vary in extent from a few acres to several square miles. Like the other types of this series, the loamy fine sand is composed of deposits laid down by the river and creeks when their valley floors stood at a higher level than at present. Since its original deposition the material has been so thoroughly shifted and reworked that it may now be regarded as much a wind-formed as a water-formed soil. The topography is level to gently undulating with a few slight irregularities caused by the wind. Drainage is good, the porous subsoil carrying off the surplus water.

The native vegetation consists mainly of sand grass and stipa grass, with some western wheat grass, grama grass, and sagebrush. The type is rather important agriculturally, owing to its large area. Probably one-half the type is in cultivation and under irrigation, being devoted to the same crops and farmed in the same way as the other Tripp soils. Yields compare very favorably with those obtained on the heavier types. The unirrigated areas are used exclusively as pasture and hay land. About 3 acres are required to produce a ton of hay. The type will support 25 to 36 head of cattle per square mile the year round.

This land ranges in price from $15 to $100 per acre, depending on the irrigation possibilities, the nearness to markets, and the improvements.

When not properly handled the soil probably drifts more than any other member of the Tripp series. It should not be left without a protective covering longer than is absolutely necessary. Applications of stable manure help to check wind erosion and at the same time supply needed organic matter.

TRIPP LOAMY VERY FINE SAND.

The surface soil of the Tripp loamy very fine sand is a light-brown to grayish-brown loamy very fine sand, ranging in depth from 18 to 24 inches. It is generally very loose and friable, but the structure is sometimes slightly compact for the first 8 inches. The surface 6 inches is somewhat darker and more loamy than the lower portion of the surface soil, as it contains a small amount of organic matter. There is very little difference between the soil and subsoil, the latter being somewhat more sandy and slightly lighter in color. The material is calcareous below 20 inches.

This soil occurs in irregular areas scattered over both the law and high terraces of the North Platte River. Areas also lie along Pumpkin Creek and its tributaries. The type is generally elevated slightly above the Tripp very fine sandy loam. It represents ma-

terial brought down from the adjoining upland and from regions to the west, and deposited as bench or terrace material along the main streams. The topography is flat to gently undulating, modified by occasional low hummocks and depressions. Drainage is good and in places excessive, owing to the porous nature of the subsoil.

This type is not extensive, but it is one of the most important soils in the county, as about 75 per cent of it is in cultivation and over half of it is irrigated. The untilled areas support a growth of sand grass and stipa grass, with some sagebrush in places, and are used as hay and pasture land. Under irrigation the yields compare favorably with those obtained on the Tripp very fine sandy loam of the low terrace. All the crops common to the region can be grown. Sugar beets and alfalfa do especially well. Land values range from $10 to $100 an acre, depending upon the irrigation development, the improvements, and the distance from markets.

This soil has a tendency to drift badly when not protected, and the unirrigated areas should be left in pasture. Fall plowing should not be done on any of the type.

The following table gives the average results of mechanical analyses of samples of the soil and subsoil of the Tripp loamy very fine sand:

Mechanical analyses of Tripp loamy very fine sand.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
372729, 372776.....	Soil.....	0.1	0.4	1.0	22.2	60.4	11.3	5.1
372730, 372777.....	Subsoil.....	.2	.5	.8	15.9	58.9	16.1	7.9

TRIPP VERY FINE SANDY LOAM.

The Tripp very fine sandy loam, to a depth of 8 to 12 inches, is a brown to grayish-brown very fine sandy loam. In places it is slightly compact, but for the most part it is loose and friable. The surface 6 inches contains considerably more organic matter than is found in the coarser types of this series. This aids in checking wind erosion. The surface soil over scattered areas has been modified by wind-blown material, giving it a loamy very fine sand to loamy find sand texture. These areas are separated where of sufficient size to warrant mapping.

Below 10 inches the soil gradually becomes lighter in color, owing to the lack of organic matter, but there is practically no change in texture to 20 inches. Below this depth considerable variation occurs. Over the greater part of the type, especially those areas adjacent to the North Platte River, the lower subsoil consists of a gray to

grayish-brown very fine sandy loam, often containing considerable silt. Numerous areas, however, particularly those along Pumpkin Creek, show very little color change within the 3-foot section, and the subsoil is generally slightly coarser than the soil.

The absence of distinct zonation over part of this type is probably due to recent deposition, the material having not as yet leached sufficiently to produce the gray to grayish-white subsoil so characteristic of the Tripp series. The lower subsoil over the entire type is calcareous.

The Tripp very fine sandy loam occurs in irregular bodies of small extent scattered over the low or first terraces adjoining Pumpkin Creek and the North Platte River, and extending for short distances up the larger tributaries of these streams. The most uniform areas are found on the north side of the river in the western part of the county. The type represents part of a comparatively recent terrace lying 5 to 12 feet above the channels. The original deposits have no doubt been greatly modified by colluvial wash from the uplands brought down during torrential rains. The soil everywhere has been influenced more or less by the deposition of wind-blown silts and sand.

The type has an almost flat surface, sloping very gently toward the main streams, and is marked by occasional slight depressions and low hummocks, due to wind action. Drainage is fairly good, despite the gentle slope and slight elevation, as the porus nature of the soil and subsoil is usually sufficient to carry off the surplus water.

Nearly all of the Tripp very fine sandy loam is irrigated. The type is very well adapted to irrigation, owing to its excellent subterranean drainage, and accumulations of alkali are rarely found on the irrigated portion of the type. It is not so free from harmful salts, however, as the soils of the high or Bayard terrace.

Most of the type is in cultivation. The remainder is used as pasture and hay land, as the native grasses make an excellent growth. The type is adapted to all the common crops, including sugar beets, potatoes, corn, wheat, oats, beans, and alfalfa. Comparatively little farming is done in the unirrigated sections. Under irrigation sugar beets yield 12 to 15 tons per acre, potatoes 150 to 250 bushels, corn 15 to 35 bushels, wheat 10 to 30 bushels, oats 20 to 50 bushels, beans 10 to 15 bushels, native hay 1 to 1½ tons, and alfalfa 3 to 4 tons in three cuttings. On the unirrigated land native hay yields one-fourth ton to 1½ tons per acre, depending on the season. The type will support 30 to 40 head of cattle per square mile the year round.

The land is usually stirred in the spring as soon as possible after the frost is out of the ground. Old fields are plowed every third or fourth year. Corn or wheat stubble is generally prepared for

small grain by double disking. No definite crop rotation is followed and no commercial fertilizers are used.

The Tripp very fine sandy loam varies greatly in price. The irrigated areas sell for $75 to $100 an acre, depending on their location. The unirrigated land ranges from $15 to $25 an acre.

This is one of the best agricultural soils of the Tripp series. It is very easily tilled, does not clod, and can be cultivated shortly after irrigation without serious injury. Practically all of the type could be irrigated.

The areas of Tripp very fine sandy loam on the high or Bayard terrace, differ from typical chiefly in the occurrence of a light-gray or almost white very fine sandy loam to silt loam or sandy clay at a depth of about 24 inches. This material generally continues throughout the 3-foot section, but in places it gives way at about 30 inches to a gray, loose, incoherent very fine sand. Occasionally the whitish material is not reached above 30 to 36 inches, and it may lie below the 3-foot section, the soil profile in such case resembling that of the Bridgeport series. These subsoil variations occur chiefly along the northern edge of the high terrace in the western part of the county, where the material is sandier and looser in structure and contains less organic matter than is typical. It has here undoubtedly been greatly modified by colluvial wash from the uplands, which has not weathered sufficiently to produce the light-colored subsoils. The lower subsoil over the entire high terrace is calcareous. The high-terrace areas represent remnants of a much older deposit than that giving rise to the low bench. They lie between 30 and 75 feet above the low terrace. The surface is nearly flat and well suited to irrigation. The high elevation and slight slope afford excellent drainage, and accumulations of alkali seldom occur. In most respects the high-terrace areas resemble the typical Tripp very fine sandy loam.

TRIPP LOAM.

The Tripp loam, to a depth of 6 to 10 inches, is a grayish-brown to brown loam, containing varying amounts of gravel, fine sand, and very fine sand. The depth and color of the soil vary with the stage of weathering and the amount of organic matter present. The average depth is 8 inches. The material to 6 inches is rich in organic matter and has a slightly darker color than the lower portion. The upper subsoil is a light-gray to light grayish-brown loam containing much small gravel. It gradually becomes lighter in color and finer in texture with depth, and below 20 or 24 inches the subsoil is a light-gray to almost white, loose, floury silt. The subsoil is highly calcareous.

The Tripp loam covers a total area of only about 6 square miles. It occurs in two areas northeast of Bayard, in T. 21 N., R. 52 W. The type represents a remnant of an old terrace formed by the North Platte River. The original deposits have doubtless been greatly modified by colluvial wash from the uplands and by the deposition of wind-blown silt and sand.

The surface of this type generally is almost flat, but varies to gently undulating along the stream channels. Drainage is adequate except in depressions where seepage waters from irrigated fields have accumulated. Even the almost flat areas have sufficient slope to afford an outlet for the surface water, and the loose, porous subsoil and substratum insure ample underdrainage.

All of this type is irrigated and under intensive cultivation, but owing to its small extent it is not as important agriculturally as the Tripp soils. Sugar beets are by far the most important crop. The smooth surface and the ease of irrigation make the type very well suited to beet growing. Alfalfa, wheat, oats, and potatoes all give good results. Sugar beets yield 11 to 15 tons per acre. Alfalfa gives a total of about 4 tons per acre from three cuttings. Wheat yields 10 to 20 bushels per acre, oats 30 to 50 bushels, and potatoes 100 to 200 bushels.

With proper methods of tillage the Tripp loam can easily be kept in good condition. Owing to the loose, porous nature of the surface soil plowing can safely be done even under adverse moisture conditions. No definite rotation is followed, as the productiveness of the soil is not in immediate danger of becoming exhausted. The land sells at prices ranging from $80 to $125 an acre, depending largely upon the irrigation possibilities.

At present there are no injurious accumulations of alkali on this soil, but great care should be taken to prevent the salts from concentrating near the surface. Irrigation by deep ditches and adequate drainage would tend to prevent crop injury.

TRIPP SILT LOAM.

The surface soil of the Tripp silt loam is a brown to grayish-brown, mellow silt loam, 8 to 12 inches deep, the shade of color depending upon the amount of organic matter present. The soil is usually fine and contains little sand of any grade. Below 12 inches the subsoil grades slowly into a light-gray, floury silt to silty clay loam. There is a conspicuous lack of organic matter below a depth of about 20 inches, which probably accounts for the lighter color of the subsoil. The type is highly calcareous below 18 inches. In some places the material below 30 inches is a light-gray to almost white, floury material which continues throughout the 3-foot section.

The Tripp silt loam occurs on the long colluvial slopes between Pumpkin Creek and the upland in the southern part of the county. It occupies the high divides adjacent to the upland and generally is surrounded by soils of the Bridgeport series. One of the largest areas occurs just west of Lawrence Fork in the southwestern part of the county.

The type consists of old alluvial and colluvial material washed down from the upland on the south. It differs from the Rosebud silt loam only in origin, the Rosebud soil being derived through the weathering of the underlying sandstone. The original colluvial material has been left intact and weathering has taken place for a considerable time, producing a light-colored subsoil very similar to that of the Rosebud series. The surface is flat to gently undulating, with a slight slope toward the north, and both surface run-off and subsurface drainage are adequate.

This soil is of minor agricultural importance, owing to its small extent. About 10 per cent of it is under cultivation, the remainder being used as pasture and hay land. The native vegetation consists of grama grass, western wheat grass, and buffalo grass and blackroot. Corn, wheat, oats, and potatoes are the principal cultivated crops. The farming methods on this type and the crop yields are about the same as in the case of the Rosebud silt loam.

Land of the Tripp silt loam sells for $15 to $20 an acre, the price depending largely upon the improvements. The low selling price of this land is due to its poor location with respect to markets and not to any lack of productiveness.

CHEYENNE SANDY LOAM.

The surface soil of the Cheyenne sandy loam is a brown to slightly grayish-brown, loose sandy loam, 8 to 12 inches deep, containing considerable small gravel and a small admixture of white, unweathered, calcareous material of the Tertiary sandstones. The organic content of the surface 6 inches is comparatively high and gives that section a darker color than the remainder of the surface soil. The subsoil is a grayish-brown, loose, incoherent sandy loam to loamy sand. There is a notable decrease in the content of organic matter below 24 inches, and at about 30 inches this material is entirely lacking. In many places a stratum of coarse sand and gravel is encountered at about 30 inches.

The Cheyenne sandy loam occurs in narrow strips along the larger drainage ways issuing from the upland in the southern part of the county. One of the largest bodies lies along Deep Hole Creek about one-half mile east of Simla, and another smaller though typical area is mapped about 1 mile southeast of Twin Mounds in T. 18 N., R. 51 W. The type represents alluvial terrace material washed down

from the upland during torrential rains and deposited in the stream valleys. It has an almost flat surface sloping gently down the valley and toward the stream channel. Drainage is everywhere adequate and in many places excessive.

The type is of small extent and of minor agricultural importance. It is droughty under dry farming methods, and has too free underdrainage to be successfully irrigated. It is used almost exclusively for grazing beef cattle and horses. The native vegetation consists principally of coarse sand grasses mixed with some grama and buffalo grass. The land is held at $10 to $15 an acre, depending upon its location and improvements.

MINATARE VERY FINE SANDY LOAM.

The surface soil of the Minatare very fine sandy loam is a loose, friable, dark grayish brown to almost black very fine sandy loam, 8 to 19 inches deep. It is rich in organic matter, and contains considerable silt and clay, which give it a slightly sticky feel when wet. Between 10 and 15 inches the soil becomes somewhat lighter in color, though it shows little change in texture. Below 15 inches there is a layer of mottled gray and white, heavy, compact clay to silty clay. This material continues to about 30 inches, below which depth a stratum of coarse sand and gravel extends throughout the 3-foot section. The subsoil is low in organic matter, but is highly calcareous. Included with the Minatare very fine sandy loam are many small areas of soil ranging in texture from fine sandy loam to loamy fine sand.

The Minatare very fine sandy loam occurs in the first bottom or flood plain of the North Platte River, occupying long, narrow strips lying parallel to the main stream. The type is encountered mainly on the south side of the river. The largest and most uniform area is mapped along the Bridgeport-Sidney road in T. 19 N., R. 50 W. Another typical body occurs in sections 25, 26, and 27, T. 20 N., R. 51 W. Two small areas are encountered north of the North Platte River. The type has a flat to very gently undulating surface, sloping slightly toward the stream. Drainage is fairly well developed, and water seldom stands on the surface even after irrigation.

This soil is of small extent, and for this reason it is not important agriculturally. The greater part of the type is under cultivation, sugar beets and potatoes being the principal money crops. Wheat, oats, corn, and alfalfa are grown to a small extent. Sugar beets yield 12 to 15 tons per acre, potatoes 100 to 200 bushels, wheat 10 to 30 bushels, corn 15 to 35 bushels, oats 20 to 40 bushels, and alfalfa 3 to 4 tons per acre from three cuttings. On the unirrigated areas native hay is the principal crop. It yields one-half to 1 ton per

acre. Land of this type sells for $50 to $100 an acre, depending upon the improvements, irrigation, development, and distance from market.

Like other soils of the Minatare series the very fine sandy loam lies in the path of seepage from irrigated areas and should be kept well drained to prevent harmful accumulations of alkali.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Minatare very fine sandy loam:

Mechanical analyses of Minatare very fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
372723	Soil	0.0	0.4	1.4	23.6	41.9	29.4	3.5
372724	Subsoil	.1	.5	1.4	22.0	31.8	32.2	12.1

MINATARE LOAM.

The Minatare loam is a dark grayish brown or almost black loam, 10 to 14 inches deep. The surface 6 inches is very rich in organic matter, contains a relatively large proportion of silt, and carries numerous small pebbles. Below 16 inches the subsoil changes abruptly to a light-gray or gray, heavy, compact clay or sandy clay, which is often mottled gray and white as a result of poor drainage. At about 24 inches there is encountered a stratum of coarse sand and gravel, which continues throughout the 3-foot section. In places this stratum is not reached within the 3-foot section, the subsoil here being very similar to that of the Minatare silt loam. The upper subsoil is generally calcareous.

The Minatare loam occurs in scattered areas south of the North Platte River. The most extensive and uniform area lies just south and west of Bridgeport. Another large area occurs south of Chimney Rock in T. 20 N., R. 52 W. The type represents recent alluvium brought down from the Brule and Chadron formations and deposited on the flood plain of the North Platte River. The original deposits have doubtless been greatly modified by recent deposits of coarser material, which have given the soil a loamy character.

The topography is flat to very gently undulating. The type lacks the extremely flat surface characteristic of the Minatare silt loam, and drainage generally is fairly good. The slightly undulating topography together with the porous substratum of sand and gravel is generally sufficient to carry off most of the surplus water, and alkali rarely occurs.

Owing to its small extent, the Minatare loam is not very important agriculturally. It is, however, well adapted to crop production, and practically all of it is under cultivation. Sugar beets are the most important crop. Potatoes, corn, and alfalfa are also grown, but they are not so well adapted to this soil, this crop giving better results on high, well-drained types. Sugar beets yield 11 to 14 tons per acre, potatoes 50 to 150 bushels, corn 20 to 30 bushels, and alfalfa 3 to 4 tons. This type is handled in much the same manner as the Tripp soils. It can generally be safely plowed in the fall, as the soil is retentive of moisture and there is very little danger of wind erosion.

This land ranges in value from $60 to $100 an acre, depending upon the improvements, irrigation possibilities, and distance from market. There are at present no dangerous accumulations of alkali on this soil, but it lies directly in the path of seepage water from the higher irrigated districts, and adequate drainage is necessary to carry off the surplus water, which if allowed to saturate the soil may bring about the concentration of alkali salts.

The following table gives the results of mechanical analyses of samples of soil and subsoil of the Minatare loam:

Mechanical analyses of Minatare loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
372747	Soil	5.5	8.6	4.3	13.7	36.9	24.7	6.4
372748	Subsoil	2.4	5.5	3.9	16.4	28.0	28.4	15.6
372749	Lower subsoil.	8.8	14.9	8.0	27.2	20.8	13.9	6.5

MINATARE SILT LOAM.

The Minatare silt loam to a depth of 10 inches is a dark-gray to grayish-brown silt loam, often containing varying quantities of fine and very fine sand. In a few of the more poorly drained areas clay has accumulated and the soil is rather sticky. The surface 3 inches is generally rich in organic matter, but below this depth there is a deficiency of this material and the soil is not easily built up. The subsoil between 10 and 24 inches is a gray, yellowish-gray, or drab silt to silty clay loam. Below 24 inches it generally becomes a heavy, compact, mottled gray and white clay to silty clay loam. In a few places the heavy, compact layer does not extend below 30 inches, the type being underlain by a substratum of coarse sand and gravel. Both soil and subsoil are hard when dry, but when in proper moisture condition are friable. Iron stains are common within the 3-foot section. The entire type is calcareous.

The Minatare silt loam occurs in the first bottoms along both sides of the North Platte River, and forms an almost continuous strip across the county. The largest and most typical areas lie on the south side of the stream. The soil consists of recent alluvium, washed largely from the Brule and Chadron formations. It has a nearly level surface, modified by occasional shallow depressions. There is only a very gentle slope toward the river, and both the surface run-off and the subsurface drainage are poor. Much of the soil has been excessively irrigated and the whole type lies directly in the path of seepage from the higher lying irrigated areas. A very small proportion of the type is artifically drained.

On the better drained areas sugar beets are the principal crop, but their yield is somewhat lower than on the irrigated soils of the Tripp series. The native vegetation consists of a good growth of salt glass, grama grass, western wheat grass, and other alkali-resistant grasses. By far the greater part of the type is used in the production of hay, the yields ranging from one-half ton to 1½ tons per acre, depending upon the drainage conditions and the amount of alkali present. The type is sometimes used as winter range for stock, hay being fed during severe weather.

Land of this type ranges in price from $60 to $100 an acre, depending on the drainage and distance from market.

Under present drainage conditions most of the type should probably be used as pasture and hay land. In many places accumulations of alkali have covered rather large, though patchy, areas with a crustal deposit. A comprehensive system of deep drainage ditches would reclaim almost all the type for farming.

LAUREL LOAMY SAND.

The Laurel loamy sand, to a depth of 12 to 18 inches, is a grayish-brown, loose, friable loamy sand, containing varying quantities of gravel. The upper 6 inches of the soil is considerably darker than the lower portion, owing to a large content of organic matter. The subsoil is a gray to dark-gray, loamy sand to coarse sand. It often contains considerable fine gravel, and in some places a stratum of coarse sand and gravel is encountered below 30 inches. Between 18 and 24 inches brown and drab-colored stains are of frequent occurrence. Throughout the type there occur areas of fine sandy loam too small to indicate on the map.

The Laurel loamy sand occurs principally along Pumpkin Creek, where it occupies a strip varying in width from a few rods to over one-fourth of a mile. A small area occurs along Lawrence Fork about 1 mile southeast of Redington. A few small bodies lie along the North Platte River. A very uniform and typical area is

mapped along Pumpkin Creek about 1 mile southwest of Courthouse Rock. The type consists of recent alluvium washed from the adjoining uplands. It is a first-bottom or flood-plain soil and occupies a low position subject to overflow.

The surface of this soil is flat, and drainage is generally poor. Owing to its small extent and poor drainage the type is of little agricultural importance. Practically none of it is under cultivation. The native vegetation consists of rushes and nutritious marsh grasses, and the type is used almost exclusively as pasture and hay land. Hay yields from three-fourths to 1 ton per acre. Potatoes are grown on a small scale and yield 50 to 100 bushels per acre. The native grasses are capable of supporting 40 to 50 head of cattle per square mile the year around.

The selling price of this land ranges from $15 to $100 an acre, depending upon the improvements, the feasibility of irrigation, and the distance from market. The higher values apply to land under irrigation and well located with respect to roads and markets.

It is doubtful if soil of this type should be used very extensively for crop production, owing to its poor drainage.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Laurel loamy sand:

Mechanical analyses of Laurel loamy sand.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
372719	Soil	6.2	19.7	12.7	29.7	19.4	8.4	3.5
372720	Subsoil	2.0	7.8	6.1	48.3	28.1	4.7	3.0

LAUREL VERY FINE SANDY LOAM.

The surface soil of the Laurel very fine sandy loam is a grayish-brown, loose, friable very fine sandy loam, 8 to 12 inches deep. At a depth of about 14 inches the soil in many places becomes slightly more compact, owing to a larger silt content. The upper subsoil is a light-gray to light grayish brown loamy fine sand. Below 24 inches the subsoil generally becomes a gray fine sand or very fine sand, often mottled brown or drab as a result of poor drainage. The subsoil is generally deficient in organic matter, and it is highly calcareous. In some places a stratum of coarse sand and gravel is encountered below 30 inches. Throughout the type there occur patches of soil resembling a silt loam.

The Laurel very fine sandy loam occurs in strips ranging in width from one-eighth mile to almost 1 mile, and often several miles in length. It is developed on both sides of the North Platte

River, and in small areas along Pumpkin Creek. A large and uniform area surrounds the town of Bridgeport. The type generally extends to the channels of the main stream. It consists of recent alluvium, and in many places is in process of formation at the present time. The soil is subject to frequent overflows and to the deposition of additional sediments by the stream. The surface is nearly flat, and drainage is inadequate, although in many places it is sufficient for the production of crops. This soil does not cover a large total area, and for this reason it is not important agriculturally. The greater part of it is used as pasture and hay land, for which purpose it ranks with the Minatare silt loam. The native vegetation consists principally of the grasses, with scattered local growths of cottonwood near the main stream channels. Sugar beets are the principal crop. Their yield ranges from 10 to 15 tons per acre. Potatoes give fair returns, but the soil is too moist for the best results with this crop.

This land ranges in selling price from $15 to $100 an acre, depending upon the drainage, improvements, and distance from market. Like the other first-bottom soils, it is subject to seepage from irrigated areas, and in places harmful quantities of alkali have already accumulated. A system of drainage by deep ditches would greatly help to reduce the injury from harmful salts.

In one area about 1 mile north of Chimney Rock, in T. 20 N., R. 52 W., and another just north of the Alliance Canal in T. 20 N., R. 52 W., the soil is more loamy than typical. It consists of 6 to 10 inches of grayish-brown to almost black loam, underlain by a subsoil of light-gray, loose porous loam to sandy loam. Below 24 inches the subsoil is composed of a mixture of coarse sand and gravel which continues throughout the 3-foot section. Both soil and subsoil are calcareous. This soil is poorly drained and of little importance. A thorough drainage system of deep ditches would greatly increase its producing power and its general adaptation to farm crops.

GANNETT LOAMY FINE SAND.

The Gannett loamy fine said, to a depth of 6 to 10 inches, is a very dark brown to black material composed of fine to very fine sand and well-decayed organic matter. The material has a spongy structure and a noticeably light weight. The content of organic matter varies greatly, but where conditions for plant growth and decay have been most favorable it is so high that the product closely resembles Muck. The subsoil is a gray to grayish-brown, incoherent fine sand, relatively low in organic matter and lacking the porous, compressible structure of the surface soil. It continues to great depths and from about 4 feet downward is similar to the

subsoil of the type mapped as Dunesand. In the more poorly drained areas, where water generally stands throughout the year, a thin layer of dark-gray or black silt to silty clay is sometimes encountered below 30 inches. Both soil and subsoil are high calcareous.

The Gannett loamy fine sand is a widely distributed type. It usually occupies small strips extending in a southeast-northwest direction, separated by ridges of typical Dunesand. One of the largest and most uniform areas lies about 8 miles east of Bonner in T. 23 N., R. 48 W.

The type is formed of the same material as Dunesand, modified by the growth and decay of organic matter. A shallow water table, permitting the heavy meadow grasses to make a rank growth, is very characteristic of the type, and it has been developed wherever the surface of the incoherent sand was lowered to approximately the level of the water table underlying the sand hills. The topography is flat to very gently undulating and drainage is generally poor, the lower areas in many places being occupied by shallow lakes or marshes.

This is one of the most important types in the sandhill section of the county. The native grasses consist of big blue stem, switch grass, western wheat grass, Indian grass, wild timothy, and needle grass. These nutritious grasses furnish the greater part of the hay necessary to winter the cattle. Heavy growths of sedges and rushes displace the hay grasses in lakes and marshes. The native vegetation ends sharply around the edges of the meadows, where a greater elevation and a deeper water table mark the beginning of the Dunesand. Hay yields one-half to one ton per acre. Over most of the type the hay is cut between September 15 and October 15 and stacked for winter feed.

Land of this type sells for $20 to $25 an acre. It is generally sold in connection with the grazing land of the sand hills, and the price obtained depends upon the percentage of hay land. The Gannett loamy fine sand should probably be used exclusively in the production of native hay, as the soil drifts badly when plowed and is poorly adapted to most farm crops.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Gannett loamy fine sand:

Mechanical analyses of Gannett loamy fine sand.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
372705	Soil	0.2	4.2	12.2	51.9	13.9	12.7	4.9
372706	Subsoil	.0	4.5	13.5	62.6	11.1	5.4	3.5

GANNETT VERY FINE SANDY LOAM.

The Gannett very fine sandy loam is a gray, dark-gray, or almost black very fine sandy loam to a depth of 6 to 8 inches. The soil is generally loose and friable and contains large amount of organic matter, which gives it a spongy structure and light weight. It grades rather sharply at 8 to 12 inches into a light-gray very fine sandy loam containing considerable silt and clay. Both soil and subsoil are generally wet, and the latter is slightly sticky. Below an average depth of 24 inches a gray fine sand is often encountered, and the lower subsoil closely resembles that of the Gannett loamy fine sand.

The Gannett very fine sandy loam occurs in irregular areas throughout the sandhill portion of the county, generally closely associated with the Gannett loamy fine sand. A very typical and uniform area lies just south of the Bridgeport-Alliance road in T. 23 N., R. 50 W. This soil has been formed in much the same manner as the Gannett loamy fine sand. It is often bordered by large ridges or hills of dunesand, but within the type little surface irregularity exists. The northern boundary of these low-lying bodies is usually a very steep dune slope, while a more gentle ascent marks the southern side. Drainage is poor, as the type lies somewhat lower than the Gannett loamy fine sand, and a high water-table level and slightly compact subsoil favor surface accumulations of water. Shallow lakes and marshes are numerous.

This soil is used exclusively for growing hay, which gives about the same yield as on the loamy fine sand. Owing to the danger of drifting it is not deemed advisable to plow any of this type except where the texture approaches a silt loam. Timothy and clover would probably give better yields than the present stand of native grasses. If practicable some leguminous crop should be generally grown, in order to obtain more forage for the winter feeding of cattle.

The price of land of this type ranges from $20 to $25 per acre, depending upon the location.

DUNESAND.

The areas mapped as Dunesand consist of a gray to yellowish-gray or brownish-gray sand, of fine to medium texture, with the fine sand predominating. There is very little change in texture to a depth of 3 or more feet. The structure is always very smooth and incoherent, with little variation from soil to subsoil. There is generally some organic matter in the surface few inches, but this is never sufficient to hold the soil against drifting when the native grasses are destroyed. Neither the soil nor the subsoil is calcareous.

Dunesand occurs chiefly in the northern part of the county, where it is the prevailing soil type, the areas being interrupted only by narrow valleys occupied by the Gannett and Valentine soils. Areas of considerable extent also occur south of the North Platte River. The materials giving this type have been accumulated by wind action, and the same force has been the controlling factor in forming its monotonous topographic features. The surface is sharply rolling, the dunes, in many places seperated by steep slopes, varying from 30 to 100 feet in height. Numerous small hummocks of wind-lodged sand, hollows, and blow-outs vary the otherwise billowy appearance of the landscape. A small proportion of the type is under active wind erosion at the present time. The blow-outs are most common on the north and west faces of the dunes.

There are no continuous waterways through the Dunesand. Intrusion of cross dunes may have hindered the development of drainage ways to some extent. The loose, porous substratum, however, absorbs all the precipitation, and there is little run-off, even on the steepest slopes. The type is unusually retentive of moisture considering its loose structure.

The Dunesand is of no importance in crop production. It is used exclusively as pasture land, except for the cutting of some hay on the more level areas. The surface in most areas is well sodded with a great number of grasses, of which the long-leafed reed grass, redfieldia, and western stipa are the most common. Soapweed, or yucca, grows thickly over much of the type. During the spring and summer months the native grasses furnish excellent pasture, but in the winter they are killed by frost and can not be depended upon for grazing. The type with its hay production is capable of maintaining between 30 and 35 head of live stock to the square mile.

Land of the Dunesand type sells for $8 to $12 an acre, on the basis of its value for grazing.

The preservation of the native grasses is essential to the utilization of this type. Patches or slashes along old roads and near watering tanks, where the wind has had an oportunity to work on the bare surface, plainly show the disastrous effects of disturbing the soil-biding roots. Care must be taken to control fires, which burn off the protective covering of grasses.

ROUGH BROKEN LAND.

The type mapped as Rough broken land includes extensive areas of badly eroded stream slopes and bluffs, which are unsuited for agriculture with the exception of included stream valleys and a few small areas that have escaped excessive erosion. The greater part of the type has been carved from the underlying Tertiary sandstone,

which is readily broken into a rough topography where erosion is active. There is usually present a considerable quantity of white calcareous stones, representing unweathered fragments of the underlying sandstone formations. Over much of the area erosion has been so severe that the surface of the ravines and buttes is almost bare except for a sparse growth of pasture grasses.

Rough broken land is one of the most extensive types in Morrill County. The largest area is a relatively narrow strip north of the North Platte River, extending parallel to that stream in a southeasterly-northwesterly direction across the county. Another large body occupies the high divide between the North Platte River and Pumpkin Creek, and represents the eastern extremity of Wild Cat Range. Large irregular bodies occur in the southern part of the county along the Morrill-Cheyenne County line.

Drainage over most of the type is excessive, owing to the steep slopes. The type is used exclusively as grazing land. The native growth of blackroot, grama grass, buffalo grass, and western wheat grass is capable of maintaining 15 to 20 head of cattle per square mile the year round, and the rough topography affords protection to stock during severe weather. The land is valued at $8 to $10 an acre, depending upon the improvements and the distance from market.

Scattered throughout the Rough broken land are areas strewn with a great variety of crystalline rocks. These consist of waterworn stones varying in size from small pebbles to fragments 2 or 3 inches in diameter. The topography of such areas is somewhat more rounded than is typical of the Rough broken land, but owing to their small extent and irregular occurrence they are not indicated separately on the map.

RIVERWASH.

Under the classification Riverwash are included the lowest lying alluvial deposits of Morrill County, sand bars and low islands over and through which the North Platte River flows, and the dry channels of small watercourses.

Coarse sands and gravel make up the greater part of the North Platte River deposit, but shallow beds of silt and clay underlain by sand and gravel occur at intervals. The entire mass generally is open and porous. Riverwash lies only a few feet above the normal flow of the river and is inundated with each slight rise. It is changed at every overflow, and even during the normal flow of the stream the material is being washed away in some places and built up in others. The type along the North Platte is generally covered with a thick growth of willow, and in some places there is sufficient grass to afford some pasturage when the river is at low level.

The type as mapped in the dry stream bottoms consists of a loose, porous mass of grayish coarse sand and gravel. The gravel is composed of a great variety of crystalline rocks and varies in size from small pebbles to stones 2 or 3 inches in diameter. Irregular fragments of the white calcareous Tertiary grit are thickly scattered upon the surface. There is practically no difference in the material within the 3-foot section. Riverwash also occurs as alluvial wash in the beds of the larger draws, the strips varying in width from a few rods to almost one-fourth mile. They generally extend down the stream channels for several miles. The material has probably been carried from the uplands during torrential rains. Most of the areas along the small streams and draws support no vegetation at all, and where grass is found it is only a very sparse growth.

Riverwash is of no value for farming, either under dry-land methods or with irrigation.

IRRIGATION.

Irrigation has been practiced in Morrill County since about 1890. The first ditches were controlled by individual farmers, and consequently served only a small acreage. They were used principally to flood wild-hay land along the North Platte River and Pumpkin Creek. At a later period canals were built by associations of landowners. The Belmont Canal was the first large ditch constructed. During the first years of its operation it was used principally to irrigate hay land, and to a small extent general farm land.

Before the construction of the Pathfinder Reservoir in central Wyoming the farmers were dependent upon the fluctuations in the flow of the North Platte River for their water supply. This stream is fed almost entirely by melting snow on the east slopes of the Rocky Mountains. Normally there was an excessive flow following the spring thaws, and the river was extremely low during the summer months, the water shortage often occurring during the growing season. The Pathfinder Reservoir was built in 1910 to aid in keeping the flow of the river uniform. It has a capacity of 1,025,000 acre-feet, and its influence is felt as far east as central Nebraska.

Of the later canals established, the Government ditches or Interstate canals and the extensions of the Tri-State Canal are the most important. The Government, Tri-State, and Bayard canals enter the county from the west, and water a considerable acreage in Scotts Bluff County before reaching Morrill County.

The following table, compiled from the records of the Nebraska State Board of Irrigation for 1914 and from information gathered in the course of this survey, gives the date of construction of the principal canals, the approximate length of each in Morrill County, and the area watered in 1914:

Irrigation development in Morrill County.

PRINCIPAL CANALS ALONG THE NORTH PLATTE RIVER.

Canal.	Date of construction.	Approximate length in Morrill County.	Area watered in 1914.
		Miles.	*Acres.*
Alliance	1893 to 1896	14	6,280
Bayard	1890 to 1893	7	.....
Belmont	1890 to 1892	41	6,646
Browns	1891 to 1895	23	3,600
Chimney Rock	1889 to 1896	11	(1)
Government canals:			
High Line	1906 to 1914	8	.....
Low Line	.....	21	.....
Lisco	1893	4	(1)
Schmermerhorn	1897	7	2,060
Smiths	1894	7	680
Tri-State	1888 to 1910	22	.....
PRINCIPAL CANALS ALONG PUMPKIN CREEK.			
Mutual	1891	3	160
Courthouse Rock	1891	5	(1)
Chance	1896	2	530

[1] No report.

The lack of statistics as to the acreage watered by the Bayard, Tri-State, and Government canals is due to the fact that these ditches are partly outside Morrill County, and the only available figures are for the total area watered by each ditch. According to field observation and to estimates of reliable farmers, the approximate area in Morrill County under each of these three ditches is as follows: Tri-State, 32,000 acres; Government High Line, 3,200 acres; Government Low Line, 9,600 acres; and Bayard, 3,200 acres. At present there is about 200 miles of main canal in the county, irrigating approximately 68,000 acres, or 8 per cent of the entire county. A large area of land, especially along the valley slopes of the North Platte River, is well suited to irrigation, and when artificially watered this land will greatly increase the agricultural output of the county.

SUMMARY.

Morrill County lies in the western part of Nebraska, in the basin of the North Platte River. The county is situated in the physiographic province known as the High Plains. Erosion, however, has lowered the surface until only small remnants of the original High Plains

surface still exist. The topography varies from flat in the alluvial lands to dissected and very steeply rolling in the rougher uplands.

The elevation of the county ranges between 3,480 and 4,540 feet above sea level. The entire area is drained by the North Platte River, which flows in a southeasterly direction across the county.

Morrill County in 1910 had a population of 4,584. The entire population is classed as rural, as none of the towns have more than 2,500 inhabitants.

The county has fair transportation facilities. It is traversed by branches of the Chicago, Burlington & Quincy and Union Pacific Railroads. The public roads are fairly good except in the sandhill portions of the county. Telephone lines and rural mail-delivery service reach nearly all sections. Omaha and Chicago are the principal markets for the live-stock products. Towns within the county furnish local markets.

The early agriculture consisted of raising cattle on the open range. The present type of agriculture consists mainly of stock raising with the production of hay and some grain for feed. Intensive cropping under irrigation is carried on in a small way along the North Platte River. The soils are comparatively new and no fertilizers are used.

Owing to the short seasons, only the hardier varieties of crops are grown. Wheat occupies the largest acreage and is the principal cash crop of the county. Corn ranks second in importance.

Land values range from $6 an acre for rough grazing areas to a maximum of about $150 an acre in the case of smooth irrigable farms.

The soils of Morrill County are classed in five principal groups, on the basis of origin, namely: Residual soils, including the Rosebud, Dunlap, and Epping series; eolian soils, including the Valentine series and Dunesand; alluvial and colluvial fan soils, including the Bridgeport series; alluvial or stream-deposited soils, including the Tripp, Laurel, Cheyenne, Minatare, and Gannett series; and miscellaneous types, including Rough broken land and Riverwash. The heavier members of the Rosebud series are well adapted to dry farming, but the sandy types should be left in pasture, owing to the danger of drifting. The Epping soils are used almost exclusively as pasture land. The Dunlap silt loam is an important agricultural soil in other portions of western Nebraska, but owing to its small acreage it is used exclusively as pasture and hay land in this county.

The Valentine soils are valuable for general farming and for hay production.

The very fine sandy loam and loamy very fine sand are the most important types of the Bridgeport series. They occur quite ex-

tensively upon the valley slopes of the North Platte River and Pumpkin Creek.

The Tripp soils are probably as important agriculturally as any in the county. The very fine sandy loam and loamy very fine sand are the principal types of this series.

The soils of the Laurel and Minatare series are used almost exclusively as hay land. The Minatare soils are occasionally devoted to beet production. Drainage of these soils is poor.

The Gannett soils are the most valuable hay-producing soils of the sandhill region.

The areas of Rough broken land are not suited to agriculture and are generally used for pasture land. Riverwash is an unimportant type.

The irrigated Tripp soils are well suited to the production of sugar beets, potatoes, and alfalfa. The Valentine, Gannett, Minatare, and Laurel soils are best suited to hay production. With artificial drainage the greater part of the Minatare and Laurel soils could be reclaimed for cultivated crops. Much of the valley slope land along the North Platte River, as yet undeveloped, is well adapted to irrigation. Stock raising will probably be the chief occupation of the county for years to come, as extensive areas of pasture and wild hay land exist.

○

[PUBLIC RESOLUTION—No. 9.]

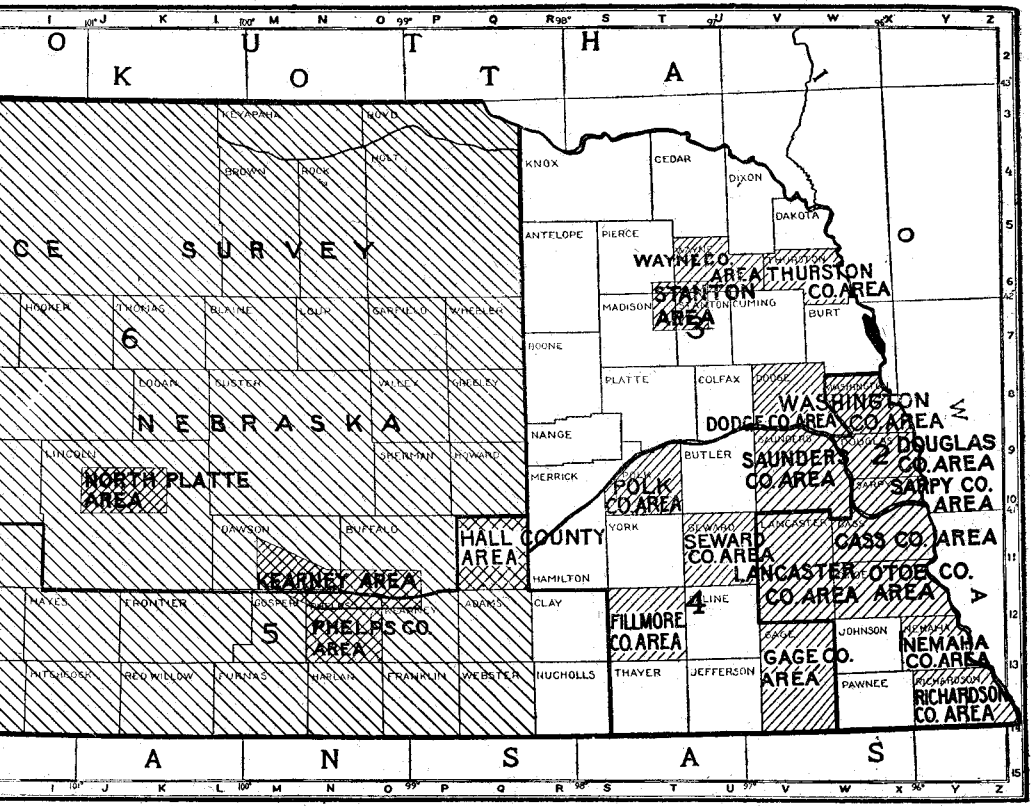
JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, be amended by striking out all after the resolving clause and inserting in lieu thereof the following:

That there shall be printed ten thousand five hundred copies of the report on field operations of the Division of Soils, Department of Agriculture, of which one thousand five hundred copies shall be for the use of the Senate, three thousand copies for the use of the House of Representatives, and six thousand copies for the use of the Department of Agriculture: *Provided,* That in addition to the number of copies above provided for there shall be printed, as soon as the manuscript can be prepared, with the necessary maps and illustrations to accompany it, a report on each area surveyed, in the form of advance sheets, bound in paper covers, of which five hundred copies shall be for the use of each Senator from the State, two thousand copies for the use of each Representative for the congressional district or districts in which the survey is made, and one thousand copies for the use of the Department of Agriculture.

Approved, March 14, 1904.

[On July 1, 1901, the Division of Soils was reorganized as the Bureau of Soils.]



Areas surveyed in Nebraska.

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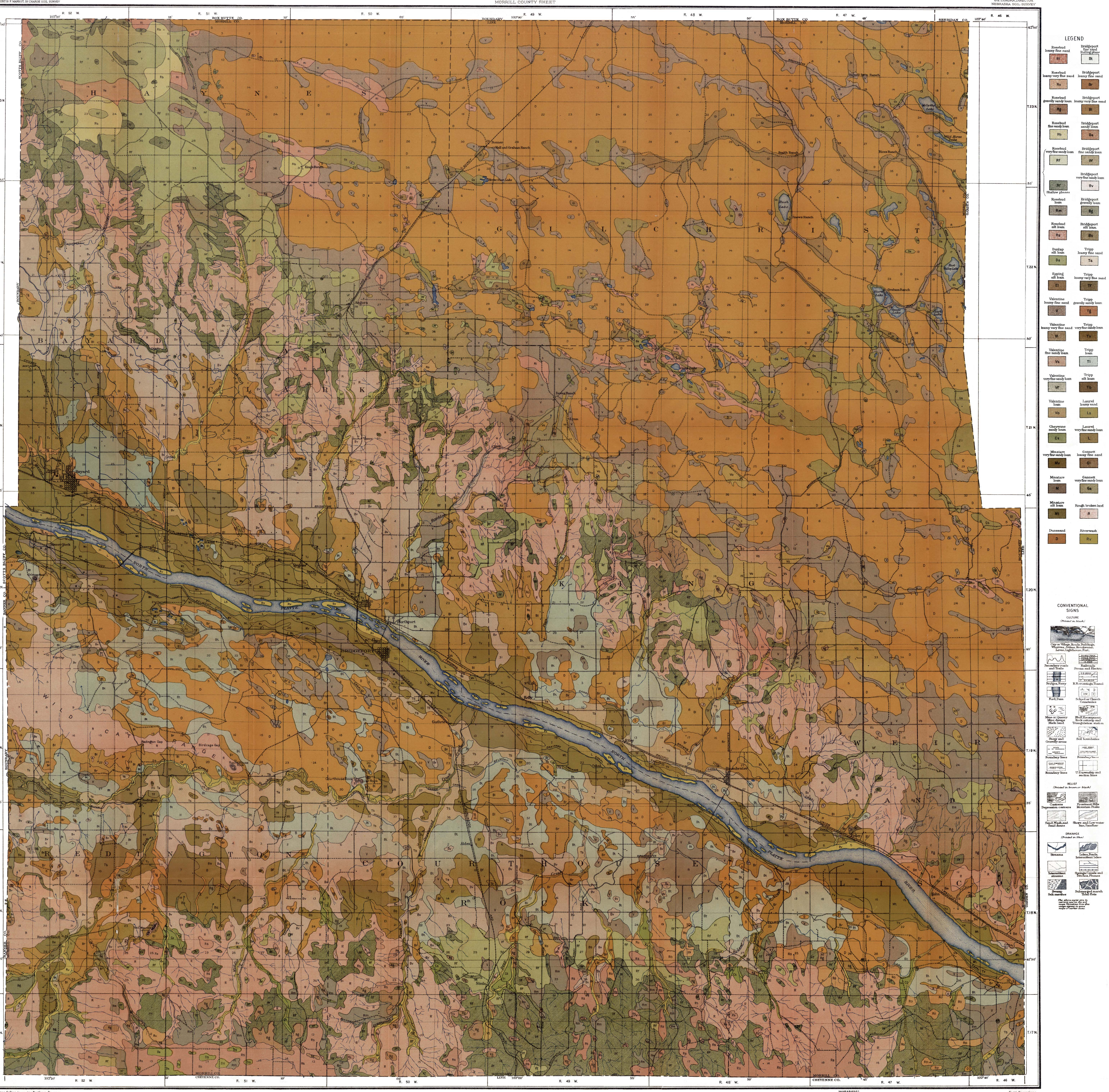
U.S. DEPT. OF AGRICULTURE
BUREAU OF SOILS
MILTON WHITNEY, CHIEF
CURTIS F. MARBUT, IN CHARGE SOIL SURVEY

SOIL MAP
NEBRASKA
MORRILL COUNTY SHEET

UNIVERSITY OF NEBRASKA
G.E. CONDRA, DIRECTOR
NEBRASKA SOIL SURVEY


LEGEND
Rosebud loamy fine sand — Rl
Rosebud loamy very fine sand — Ro
Rosebud gravelly sandy loam — Rg
Rosebud fine sandy loam — Rb
Rosebud very fine sandy loam — Rf
Shallow phases — Rf
Rosebud loam — Rm
Rosebud silt loam — Rs
Dunlap silt loam — Ds
Epping silt loam — El
Valentine loamy fine sand — V
Valentine loamy very fine sand — Vl
Valentine fine sandy loam — Vs
Valentine very fine sandy loam — Vf
Valentine loam — Vo
Cheyenne sandy loam — Cs
Minatare very fine sandy loam — Mv
Minatare loam — M
Minatare silt loam — Mt
Dunesand — D
Bridgeport fine sand Rolling phase — Bt
Bridgeport loamy fine sand — Br
Bridgeport loamy very fine sand — Bl
Bridgeport sandy loam — Be
Bridgeport fine sandy loam — Bf
Bridgeport very fine sandy loam — Bv
Bridgeport gravelly loam — Bg
Bridgeport silt loam — Bs
Tripp loamy fine sand — Ts
Tripp loamy very fine sand — Tf
Tripp gravelly sandy loam — Tg
Tripp very fine sandy loam — Tv
Tripp loam — Tl
Tripp silt loam — Tb
Laurel loamy sand — Ls
Laurel very fine sandy loam — L
Gannett loamy fine sand — Gl
Gannett very fine sandy loam — Gs
Rough broken land — R
Riverwash — Rv
CONVENTIONAL SIGNS
R. 52 W.
R. 51 W.
R. 50 W.
R. 49 W.
R. 48 W.
R. 47 W.
R. 46 W.
BOX BUTTE CO.
MORRILL CO.
SHERIDAN CO.
CHEYENNE CO.
BOUNDARY LINE
T. 23 N.
T. 22 N.
T. 21 N.
T. 20 N.
T. 19 N.
T. 18 N.
T. 17 N.
42°00′
103°20′
103°00′
102°40′
Bayard
Bridgeport
NORTH PLATTE RIVER

Thomas D. Rice, Inspector, Northern Division.
Soils surveyed by F.A. Hayes, in charge, and
H.W. Hawker, of the U.S. Department of Agriculture,
and M.D. Davis, and V.H. Seabury, of the Nebraska Soil Survey.

Scale 1 inch = 1 mile

Field Operations
Bureau of Soils
1917